JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXVII., No. 2544.—TUESDAY, FEBRUARY 13, 1912.

EDITORIAL NOTES—GAS, &c.

Influences on Gas-Trading Fortunes.

THERE was an absence, at the meeting of the Gaslight and Coke Company last Friday, of that governing individuality that Mr. Corbet Woodall, when in the chair, seems to throw over the Horseferry Road assemblies. With all respect to the Deputy-Governor (Mr. Ulick J. Burke) and his colleagues, the feeling that there was something wanting on this occasion pervaded the meeting; and the regret was obviously general and sincere, without the telling, that the Governor's absence was due to imperative, but on his part reluctant, compliance with his medical adviser's orders. The regret, however, was leavened with the satisfaction of knowing that Mr. Woodall is stronger than he has been, and is looking forward to an early resumption of active participation in the work of administering the Company's affairs. However, absence supplied an opportunity that could not be missed. The proprietors and the gas industry know the location of the source of greatest influence in the heavy work that has had to be performed in liberating the undertaking from the entanglements that embarrassed and hindered its progress. But those who work behind the Board-room doors know better than anyone else how copious has been the influence from that source; and it was in graceful and genuine terms that the Deputy-Governor made acknowledgment of this in the Governor's absence—an acknowledgment couched in terms that would have been impossible in his presence.

The Governor had indited his address; and it was read by the General Manager (Mr. D. Milne Watson). It treated of many matters financial, administrative, and manufacturing; and as the words and sentences fell, the proprietors must have been impressed with the fact that the huge undertaking has never been, in its century of existence, in better case. Financially strong, with a price of gas that has only once for so brief a space been touched before that the fact had been lost to memory, with opportunities larger than ever, and with thousands of workers in a condition of attachment to the Company that is unprecedented, the matter composing the address was good. We dealt fully with the financial aspects of the Company's affairs last week; but there are other subjects in the Governor's address with broad interest that may be touched upon. If there is one thing more than another that the address illustrates, it is the revolution that has taken place in the conditions of the industry. To-day the industry is classed more than ever it was, and the classification is year by year becoming accentuated, among those trading enterprises that have very considerable reliance in the matter of their fortunes upon suitable temperature conditions for maintaining and raising the top lines of the business curve. Last half year, the Company had a drop in the consumption of gas of 0·96 per cent.; and the Governor indicated by statistics how this fall coincided with higher temperature conditions than ruled in the corresponding half of 1910, when there was an increase in sales, as there has been in adjoining half years. The mild weather continued into January of this year; and up to Jan. 23 the demand for gas receded by 65 million cubic feet. But what has happened? Colder weather superseded the mild; and in the short space of ten days, the deficiency had been wiped out, and 27 million cubic feet additional sales had been recorded. This is one of the best illustrations that we have had in these days of the sensitive responsiveness of gas consumption to temperature conditions; and it strikingly points the growing realization that the gas industry has a remarkable scope for business before it in effecting the displacement of solid fuel.

In brilliant relief, there stood out from the address the strength of the belief of the Governor in the prospects of the industry, and in its capacity for meeting equally with—perhaps in some respects better than—other industries the burdens and anxieties that increase, and affect the community and enterprises generally, with somewhat uncomfortable vigour. In new connections of consumers, in new business domestic and industrial, the trading base of the industry broadens and deepens; and this enables the administrators to look upon fluctuations in actual consumption with more composure than of old. Expansion of base, however, is not obtained without expense; and the Governor, in his addresses, never tires of pressing home the truism that the higher rate of expenditure in the distribution department is profitable and a protection. It is insufficient to occupy a "premier place in economy and efficiency." Competition is rife, and militantly active, without on one side much regard for orthodox commercial principles; and therefore working for the satisfaction and improvement of the knowledge of the gas consumer is a paramount necessity. The policy is broad and sound that looks upon such additional expenditure in the light of the premium for business insurance and development.

There is the future to be faced. A further reduction of 1d. in the price of gas in the case of the Company takes effect from the beginning of this year; and this represents the abandonment of a large revenue—more than £100,000 a year. More probably will have to be paid for coal. A few thousand pounds additional expenditure will be absorbed through the operations of the Insurance Act. The Directors have thoroughly surveyed the position; and the accounts are their warrant for the course they have taken in making the reduction. The most ominous factor in the situation is found in the coal trade, with its possible heavy liabilities. Still the Company are strongly entrenched in regard to their coal supply; and the Governor feels more than ever in these troublous times in connection with the labour external to the gas industry upon which it has large dependence, that the industry has a potent auxiliary in carburetted water-gas plant, with its capacity for making five times the quantity of gas from a ton of coke (with oil enrichment) that can be produced from a ton of coal. Incidentally, he emphasized all the horrors that must follow in the train of a national coal strike; and he expressed the fervent hope that these horrors might be averted by wise counsels leading the parties to a peaceful issue, out of what unfortunately for the moment looks like a deadlock. That is the prayer of all; though at the same time it is hoped that, if there is a peaceful issue, it will be crowned by justice. However, in the midst of it all, the address outlines the material and financial strength of which the gas industry can rightly boast in relation to these matters.

There is only one other point to which special attention may be directed. In our comments last week, mention was made of the fact that the make of gas per ton had been reduced; but there was no reason that could then be, with any confidence, assigned for the changed circumstance. It appears from the Governor's remarks that the reduction in make is largely a deliberate, experimental move, made in the quest for information to determine how far a high yield of gas harmonizes with the obtaining of the fullest value for the bye-products. The investigation is still proceeding. Having regard to the magnitude of the Company's manufacturing operations, the investigation is a considerable one, and to it the touchstone of financial expediency must later be applied.

Suggested Settlement of Depreciation Allowance.

THERE is an opportunity now for gas companies combining in an attempt to come to some definite arrangement with the Inland Revenue Authorities as to a basis of allowances for depreciation in respect of income-tax. But it is necessary and important that companies should evince interest in the matter by themselves forwarding the movement for obtaining the desirable end. This can be done simply and readily by communicating with Mr. W. A. Schultz, F.C.A., of No. 50, Cannon Street, E.C. As is well known, Mr. Schultz (himself very largely interested in gas undertakings) has taken a

prominent part in appeal work before the Commissioners on this particular subject, since the issue of the famous circular by the Inland Revenue Authorities in 1909, which definitely instructed the Surveyors to, under no circumstances, make any allowance for depreciation of gas-works plant, save for actual renewals and replacements. The circular was ill-advised, and has caused a considerable amount of unnecessary trouble and waste of time on the part of all concerned. We have no hesitation in saying that Surveyors as well as Commissioners to whom appeal has been made have just as pronounced views of the unrighteousness of the circular as have the administrators of gas undertakings against which it was unjustly directed. Acting upon the circular as they were in duty bound, the the Surveyors (together with the Inland Revenue Authorities) have had to face the fact that in every case, so far as we are aware, the gas companies—companies operating in England, Ireland, and Wales—who have appealed through Mr. Schultz or others have established their right to allowance for depreciation, to such an amount as the Commissioners considered to be equitable, in respect of the diminishing value of their plant.

The result is, it is quite clear, that the principal officials at Somerset House are now satisfied that the case for the companies is perfectly reasonable and legitimate; and the only question remaining is as to what depreciation shall be allowed. No official overtures have been made. But in connection with cases now pending in which Mr. Schultz is concerned, it has been suggested to him that he should consent to an adjournment, and obtain the authority of gas companies to negotiate a basis upon which future claims can be settled. It is understood that it is the intention of the Inland Revenue Authorities to ask for an adjournment of all similar cases that are now pending, in order that some arrangement of this sort may be brought about. Mr. Schultz is conferring with representatives of the Institution of Gas Engineers, the Gas Companies' Protection Association, and of various companies; and it is hoped that gas companies generally will come forward and assist by giving the necessary authority for an attempt being made to arrive at the suggested basis of allowance. Hitherto many gas companies, we regret to say, have been somewhat apathetic over this matter. Really only a small percentage have come forward to claim their depreciation allowance, though they have been kept informed, through our columns and in other ways, how the question stands, and of the success of those companies who have moved in the matter of establishing their undoubted right. It is through the work of the gas companies who declined to take the mandate of the Inland Revenue Authorities lying down, that the present open road to a settlement has been arrived at. But the strength of those who will be negotiating the basis on the part of gas undertakings will be in exact relation to the amount of authority with which they go armed before the Inland Revenue Authorities. It is a big thing for the gas industry. Any settlement that is now arrived at will not apply merely to this year or to next; but we hope it will be of a character that will hold good always. Let it be remembered, too, that whatever arrangement is now mutually come to, the Inland Revenue Authorities will seek to uphold and to apply generally. Therefore, companies should in their own interests communicate with Mr. Schultz, and join in this simple movement that it is hoped will have an important and agreeable ending to all concerned.

Tar Surfacing and Fish Poisoning.

THE sporadic allegations that the employment of tar on the surfaces of roads has been responsible for the destruction of fish in rivers, streams, and ponds, and the fear of trouble that has been engendered by the allegations, have caused some amount of inconvenience to county and other road authorities; but when the available evidence points to the fact that there are no more dead fish than aforetime in rivers, streams, and other places, it is clear that assumption has been strained to its fullest limits. Moreover, granting that the mortality among fresh-water fish has been in recent years greater than previously, there is no justification for saying, without proper examination, that it is due to the use of tar on roads in the neighbourhood of the habitat of the fish, any more than there is for jumping to some other conclusion as to a prevalent disease or other cause. But tar-surfacing being suspect by those with fishery interests, the duty is imposed of investigating the matter, and, if possible, of allaying their apprehensions. The first question arises as to how the matter should be investigated, in order to arrive at proper conclusions; and it seems to us that a start should be made in such an inquiry with the fish that it is believed have been poisoned, and with frequent samples of the water in which they have come to the end of their existence. To commence at the opposite end, and to inquire as to the effect of tar-and-water solutions on various fish under conditions that do not in any single circumstance reproduce the conditions from the tarred road surface to the rivers or streams, nor the conditions of liberty of action under which the fish live, may in the event be more calculated to accentuate the belief in the allegations than otherwise.

However, Mr. W. J. A. Butterfield, M.A., F.I.C., has carried out a series of investigations to ascertain the effect not of the washings from tarred surfaces that may be discharged into streams in which fish are resident, but to determine the effect upon the life of fish confined in water impregnated by ingredients that—by agitation, and in stagnant condition in contact with tarred surfaces—it has extracted from the tar. Mr. Butterfield has exercised a great deal of care in carrying out this investigation; and the results are highly valuable within limits, and provided they are not misapplied to conditions not represented within the scope of the experimental inquiry. The limit of value is in showing those ingredients of tar that are most harmful to various fish, and the elimination of which from tar to be used in the neighbourhood of fishing waters will act as an additional protection and a preventive of trouble. The lines and the results of the investigation were described in a paper that the author submitted to the Institution of Municipal and County Engineers last Friday; and those who study the paper should not miss reading the discussion and Mr. Butterfield's reply upon the latter, as these clearly present the qualifications that must be applied to the detailed experiments.

The author freely acknowledges that his experiments were extreme in their character; and that they show the worst results obtainable in the mortality of fish through confinement in a solution containing, to fish, fatal quantities of toxic ingredients drawn from the tar. In the first place, non-absorbent surfaces of vessels were coated with tar; and those surfaces are not typical of the absorbent surfaces of roadways. The water was kept in contact with these surfaces, whereas the tendency of water falling upon tarred roadways is to at once pass away; and therefore the contamination of road washings by the tar cannot be anything like the contamination that would proceed from a tarred non-absorbent surface, with a definite quantity of water agitated over it, and then standing for long periods. Under such circumstances, there can be no comparison in the matter of dilution. Again, the washings from the road surface will probably pass through sand or soil or in contact with some vegetable or organic matter, and so be filtered in some way; and where this is the assured case, Mr. Butterfield himself agrees, there need be little fear of using even crude tar in the neighbourhood of streams. Then the washings from the roadways are further diluted on entering the streams. Moreover, the tarred surfaces cannot go on perpetually yielding the toxic phenolic and other ingredients. Passing still further, the experiments came in for the criticism that the fish used had been removed from their native conditions; and the handling and transfer from natural to unnatural conditions no doubt reduced their power of resistance. With fish as with human beings, self-preservation is the primary law of Nature; but confinement in the tar-impregnated water gave the fish no liberty of action.

Mr. Butterfield, in his reply, practically admits the truth of all such criticism of the character of his investigations, as well as the fact that many of the points were recognized by him early in the experiments. But he claims that his inquiry points to this—that tar, if reasonably free from ammonia and tar oils (that is, "freed" tar) is, under all ordinary conditions, absolutely safe to use in the neighbourhood of fisheries. But fisheries do not abound in all neighbourhoods, and all washings from tarred road surfaces are not discharged into streams containing fish. Therefore it seems to us, and the experience of road surveyors hardens their opinion, that the field for the use of crude tar without trouble is infinitely greater than the field in which the use of freed tar is perhaps desirable for the purpose of removing suspicion. The discussion further shows that those responsible for the use of tar in the neighbourhood of streams find that, with the precautions and the operation of natural conditions, no harm has

arisen. On the other hand, Mr. Butterfield holds that his experiments are an index to the ingredients of tar that are most menacing to fish life; and therefore, in the neighbourhood of fishing waters, the use of tar in which these ingredients have been reduced to safe limits will be reassuring and a protection. That is where the value of Mr. Butterfield's paper comes in. It does not prove that the fears or suspicions of fishery owners are justified, nor does it prove that any harm has arisen to fish in their natural state from the washings from tarred roads. And Mr. Butterfield does not suggest that it does. Anyone who so interprets and applies the results of the experiments will no doubt be told by their author that it is a gross misuse of them.

Coke Improvement by Injury Prevention.

RENEWED attention has been directed lately to the question of the improvement of the chief of the secondary products of gas manufacture. Professor Vivian B. Lewes urged the importance of something being done in these days of high-temperature carbonization in order to improve the domestic demand; but his plans for betterment involve many considerations and many uncertainties. From time to time, projects have come before us that show that some of the thinkers in the coke-producing industries have been attempting to contrive means for effecting an improvement in the coke by subjecting it to less drastic methods after it leaves the retort or other carbonizing chamber—in other words, the line of work has been not to enhance the value of the coke by adding to its inherent properties, but by saving those properties from depreciation by the treatment to which the incandescent coke is exposed. The present methods of coke ejection, transport, and quenching—in varying degree, and each contributing more or less to one or other of the defects of the processes—produce smoke, dirt, and intense heat; small, breeze, and dust; waste from combustion through the air getting to the coke; and the material becomes saturated with water, which detracts from the calorific value. These are the drawbacks of current practices that are only too well known. Yet the years have passed, and there seemed to be no practicable means of escape from the depreciating influences of these practices. One of the latest introductions in the matter of coke quenching—immersion in a deep-water tank, as part of the telpher system of coke transport—has been condemned by some gas engineers, though others have not found any particular disadvantage (owing probably to the difference in the physical characteristics of the coal). But it is reasonable to suppose that plunging red hot coke into cold water would do harm to its stability, beyond which, it has been proved, that the absorptive power of red-hot coke on being immersed in water is greater than it would be if the material had been cooled, or partially cooled, before immersion. With the telpher arrangement as we have seen it worked, there is a prior sprinkling of the coke within the retort-house; but this can only impart a slight temporary deadening, as the rapid rise and passage through the air before reaching the quenching-tank must have the effect of largely restoring the incandescence by transit fanning-up the combustion.

It has been known that the question of improving the commercial value of coke has been for some time under consideration at the Liverpool Gas Company's works; but as to exactly the lines that were being taken it has not been possible to speak, until Mr. Edward Allen and his co-worker in this matter, Mr. R. E. Gibson, had fully protected their invention. This has been done; and the patent specification is published. Looking at the details, and those of prior work, there seems to be practically only one alternative to the quenching process, and that is smothering the coke in some way. The "Charco" system that was brought before us some time since proposed the smothering of coke by covering it with breeze. The suggestion, however, has not proved practical for general adoption in the large-scale operations of modern works; and the old ways have prevailed. There have been proposals for quenching in closed vessels —some water-jacketted, some not; with self steam-generation or without; and, where with, the steam being used for quenching the coke. But, for one reason or another, the projects have fallen aside without taking place among the serviceable methods. The defects of the past in the systems of smothering or quenching coke in closed vessels are what Mr. Allen and Mr. Gibson have endeavoured to surmount by the system they have now proposed. A box has been designed, into which the coke can be discharged from the retorts without injury; it is fitted with air-tight lids to prevent combustion; the retort-house men are protected. The box of hot coke is dealt with by the telpher system; and it is immersed in the quenching-tank. Thus the coke is dry-quenched; and its calorific value is fully maintained.

Coke so dealt with under this patented arrangement, we can well conceive, will have an improved commercial value. It would, however, be interesting to know whether the coke so treated has been analyzed to ascertain whether there are any differences between the resultant material and that dealt with by the old processes. The reason the question is put is that one of the advantages claimed for the plan of smothering by breeze was that the method gave vent for the volatile arsenic and sulphur, and the emission of other gaseous impurities. If this is actually the case, it follows that enclosure in an air-tight vessel would not allow the vent that was submitted as an advantage in the older system. There are other points upon which readers will like soon to have the experience of Liverpool. What about the capital and working expenditure attaching to the system? Does the handling of the coke in this manner in any way impede the retort-house operations? It must at any rate take much longer to quench the coke enclosed in an air-tight box than by free and complete immersion in water, with the latter in direct contact with the material. The advantages are obvious; but what has to be paid for them?

From Laboratory to Working Plant.

THE subject of scientific control in industry is one to which there has been reference from time to time in these columns. In our travels among the works of the gas industry, there is observed an increasing recognition of the benefits in economy and productive improvement of scientific control. But in this as in other things, application has its right and its wrong ways. We are reminded of this by a very readable article—it is evidently to be the first of a series—that has appeared in the "Engineering Supplement" of "The "Times." This particular article deals with the "Limita-"tions of Laboratory Tests." There is a great deal of truth in what is said in it; and a very good case for a revision of ideas as to what is meant by scientific control. Some manufacturers who have not inquired into this matter possess ideals of scientific control that do not soar above the establishment of a laboratory, and the installation in it of one or two analytical chemists, who, if they have not been taught in the right schools, will merely deal with the infinitesimal within the confines of the walls of the laboratory, and will not carry their science out into the highways and the byeways of the plant which their training and their scientific acquisitions are intended to enable them to control. If it has to have a genuine value, scientific control cannot be confined to the examination of occasional small samples, supplemented by laboratory research. Real scientific control is something of a much wider nature. It is something that must be continuous; and not spasmodic. It is something that must guard from day to day the maintenance of the value of incoming material and the working results. It is something that must go right to the root and body of processes and actual working-plant organization, and must not be restricted to merely attempted miniature reproduction, under conditions that have no more likeness to working circumstances than a small steam-launch has to a Dreadnought. The laboratory is useful as the centre of operations, in the examinations and checkings of working results. These are the teachings of the modern university —they are the teachings of the Gas Engineering and Fuel Department at the Leeds University; they will be the teachings of Dr. W. A. Bone when he develops the department of which he was recently invited, and has consented, to take charge at the Imperial College of Science and Technology at South Kensington.

A broader view of scientific control than the mere laboratory one can only be of real permanent advantage to the manufacturer. In his recent Cantor lectures, Professor Vivian B. Lewes showed how the laboratory 2·2-lb. coal test is of no real use to the gas manufacturer. In the first place, such a test gives no assurance as to the coal from day to day being the same as the material the 2·2 lbs. represented; and the test does not reproduce in any way the conditions under which the coal is to be carbonized, so that the results are again of no value as indicative of what may be expected from the coal. The physical and the chemical properties of coal vary to such a degree that, whether the

coal is required for its products or for its heating value, it is essential that, in the interests of the manufacturer, the check on its quality should be continuous. And, further, the laboratory experiment is of no real use, in that the conditions are altogether dissimilar from those under which the coal is to be actually employed. In the matter of coal carbonization, the small laboratory test charge, allowing as it does a rapid transmission of heat through it, is, as we have said before, no reliable guide as to what will happen in the case of a retort charge of (say) 10 cwt. or 12 cwt. Between the test and the working conditions, everything is different—in the furnaces, combustion and temperatures; in the retorts, girth of charge, rate of travel of heat, and other things. This is pointed out in the article before us in these words: "Chemical and laboratory tests will not indicate, with "any degree of certainty, how the coal will behave in a "producer, a boiler, a coke-oven, or a high-temperature "furnace; and to stop at laboratory tests is to be content "with a control which is really unscientific because the "results do not throw light on the most important practical "considerations." That is the point. There has been an awful mass of fruitless laboratory work in the past, owing to the methods of its prosecution having been fashioned by those whose ideals in this regard were unscientific because they were not representative. The results had a value application only to the methods employed; they were no index to the results procurable under actual working conditions. Where conditions have no correspondence, results cannot have any genuine relationship or reliability. Therefore, scientific control must have its foundation in the working plant itself, or in an independent plant built on a working scale, and that plant must itself be subject to scientific inspection and control if the best is to be obtained out of it. The laboratory is the place where exact examination can be made of the products of the actual working operations.

Knowledge is spreading of what is requisite in this matter of scientific control. But the knowledge has not reached all manufacturers; and there are still analytical chemists who have been trained in the midst of the habits and traditional beliefs of the old school who decline to see value or exactitude in anything done outside the walls of the laboratory. They have to be dragged from their dark old notions into the light of practical procedure, and be made to see that the most scientific representation and interpretation of result from actual working can only be obtained by tests based upon the products of the working conditions, which conditions their own further scientific tests can best describe, as well as determine the degrees or combinations thereof at which, or by which, the highest value or efficiency is obtainable. The progressing recognition of the true place and practice of scientific control in industry must depose the old-fashioned and mistaken notions as to the infallibility and applicability of methods beginning and ending in the laboratory; and manufacturers must see to it, in their own interests, that the deposition proceeds promptly, and is not barred by individual obstinacy against seeing things in the light of the present day.

Margam Arbitration Award.

The award in the arbitration between the Aberavon Corporation and the Margam Urban District Council has been promptly issued; and readers will still have clearly in mind the circumstances of the case (which was one of severance), as set forth in the report of the proceedings which appeared in the "JOURNAL" three weeks ago. The arbitration was an interesting one in several respects. Margam last year secured an Act to compulsorily purchase the part of the Aberavon undertaking that was in their area; and the portion to be acquired consisted of mains, &c. —the manufacturing works being in Aberavon. So that, after the transfer, the Corporation would be left with surplus works, which would be of no use to them until the consumption in their district had grown sufficiently to utilize them; and this, it was calculated, would be seven years hence. Taking everything into consideration, and adding 10 per cent. for compulsory sale, the Corporation claimed a total of £51,863. The Margam Council, however, took a different view of things; and, while admitting that what had to be paid was, in the first instance, the value of the maintainable profit, they argued that to arrive at this profit involved consideration of the trend of recent legislation in the direction of the restriction of the amount of profit that should be made by local authorities out of consumers of gas situated, as Margam was, in outside districts. What they maintained was that Aberavon were practically at the end of their financial tether, and would soon have had to apply to Parliament for further capital powers, when Parliament would have prohibited them from continuing to draw from the Margam portion of their supply area the income that they were now enjoying, and on which the maintainable profit claimed was based. The Oldham, Salford, and Glasgow Bills were urged as showing the present policy of Parliament; and a valuation was submitted based on the assumption that the future of the undertaking would be limited in the same way as Glasgow had been limited. This valuation produced a figure of £9441. To this reasoning, the Corporation replied that no one was in a position to say what Parliament would do—what the tribunal had to deal with was the Act of Parliament under which Margam was purchasing. Several cases, too, were quoted of 1911 Bills in which municipalities supplying outside districts secured further capital powers without restrictions. The award puts the amount which the Margam Council are to pay to Aberavon at £30,840.

Consumption Development and the Existing Customer.

In a communicated article on "Free Gas Appliances" in another column, the inspiring source of which was the recent report by Mr. W. R. Herring on the question of developing the day-load at Edinburgh, the writer calls attention to a point which he thinks requires emphasizing, and that is the relative cheapness of developing additional consumption among existing consumers, as compared with the obtaining of entirely new consumers. He finds that more energy and labour are required in obtaining new consumers than in persuading existing customers to increase their patronage by putting gas to greater service. Of course, this largely depends upon the class of resident, and the opinion would have to be modified accordingly. However, it is obvious that it is far cheaper to connect up a new gas-consuming appliance to an existing house installation than to put in a complete new service, meter, and fittings. But the question as to which is in the long-run the more profitable will depend on the number of new gas-consuming appliances that would be required to equal the one new customer, unless he be a very poor one. The point as to developing business with the existing consumers is one to keep well in the minds of canvassers and others who work for the development of gas sales. Our contributor is also of opinion that as, under the present order of things, saturation-point is reached in a district, the free supply of gas-consuming appliances becomes a matter of practical politics.

Inferior Mantles.

The South Metropolitan Gas Company have found it necessary to publish a notice in the local papers warning gas consumers against purchasing mantles of an inferior quality hawked from door to door by persons suggesting that they are agents for the Company. There has been personal experience of this proceeding —the men hawking mantles representing themselves as from the "Metropolitan Gas Supply Company." That is near enough to deceive the ordinary consumer. Other companies may well keep an eye open to see that these gentry do not bestow their attentions on their districts. In the case of the South Metropolitan Company, without warning, consumers might be easily misled, as the Company do, at their showrooms (or by orders given through their representatives), sell a mantle of guaranteed good quality, labelled "Metro."

Municipal Gas Profits.

An application by the Darwen Corporation to the Local Government Board for sanction to borrow a sum of money to cover the cost of gas-main extensions over the next three years, was the occasion of a lively debate on the question of the making and disposal of municipal gas profits. Advocates of cheap gas rather than big profits had a doughty champion in Mr. Thomas Duxbury (formerly Manager of the gas-works), who presented a strong argument in a convincing manner. He is opposed to the handing over of gas profits in relief of rates and for other purposes; and he made no secret of the fact that, in view of recent well-known experiences of municipalities when before Parliamentary Committees, he would have liked to see Darwen go to Parliament, instead of to the Local Government Board, for the money. The Town Clerk urged as an objection to this course the

matter of expense; but he admitted that his Council were not desirous that their old Acts should be abrogated—"for that is what it would come to." From the full report of the proceedings which appears in the news columns, it will be seen Mr. Duxbury contended that as the gas consumers pay the cos' of the gas and the capital charges as well, they are the ones who are entitled to the benefits secured by their own money. Had this money all along been utilized to reduce the capital account, instead of being handed over to the rates, or to other less successful departments, the position of the gas consumers would, of course, have been better than it is; and all who cared to make use of the cheap gas supply would have benefited. Even non-users would secure an advantage, in a purer atmosphere, from a larger consumption of gas in the town; and might not this be considered as a sufficient return to them for the "risk" regarding the gas undertaking which they are said to incur as ratepayers? It is true that even a purer atmosphere would not be of direct benefit to the great number of owners of cottages in Darwen who, according to Mr. Duxbury, are "absentee landlords;" but they can always go and live in Darwen if they desire to enjoy the advantages of "their" gas undertaking. It seems that, in addition to relieving the rates, the Darwen Gas-Works have, on occasion, been called upon to come to the rescue—and to the tune of a substantial sum—of both the Water and the Electricity Departments. So that even in this town, when there are deficiencies, the loss does not fall directly on the general body of ratepayers, but upon that section of them which comprises the gas consumers! This does not help the argument of "risk" to ratepayers as a whole, which is advanced as the great justification of taking big sums from gas consumers.

Standard Gas-Fire Fuel.

While the makers are engaged in controversy with the laudable object of raising and maintaining the standard of gas-fire construction is a convenient time for their customers to come forward with suggestions. There is one on a matter of detail which Mr. J. Ferguson Bell puts forward this week in our "Correspondence" columns. To buyers, users, and those who have to maintain gas-fires in a state of efficiency, this particular detail is one of considerable importance. It refers to the variations of the fuel or "radiants" that the different makers supply, and which variations are of a kind that necessitate the keeping in stock by gas undertakings of a multiplicity of makes of fuel. This is not only burdensome, but it increases the cost of labour in maintenance. Mr. Bell pleads for interchangeability of fuel between various makers' fires; and we fully sympathize with the request, for the advantages (which will extend with the advancing use of the gas-fire) are too obvious to admit of any contention. Each maker has his own ideas in this matter; and each maker claims individual merit for his fuel. What, however, Mr. Bell asks for is not that makers should depart in any way from their ideals as to the physical qualities of their fuels, nor from their preferences for the character of the design of the fuel in regard to thickness or openings, but for uniformity in size and configuration, in order that he and others may have the privilege of selecting any type fuel they like, which will be suitable for any fire, and simplify stocking and maintenance work. We see one drawback; and it is that uniformity of size of fuel to enable interchangeability will mean uniformity in the size of burners and nozzles, varying, of course, with the size of the fire. However, the matter is one for the consideration of the makers. We can quite understand there is not one of them who desires to lose his trade in the supply of fuels. But in favour of interchangeability of fuel, there is the consideration that it would induce buyers to distribute their orders for fires where now possibly, through this drawback as to the multiplicity of fuels, they restrict the number of the firms with whom they place orders. Further, Mr. Bell is persuaded that the course he suggests would be a boon to the users of gas-fires, and would lead to a further extension of the employment of gaseous fuel for heating purposes. It is a good "free trade" proposal; and we shall be pleased to hear from the makers regarding it.

Beet Growing at Home.

Sulphate of ammonia producers are no doubt keeping interested eyes on the movement for establishing the beet sugar industry in this country. The latest information is that the Anglo-Netherlands Sugar Corporation have purchased a site for a factory at Cantley, on the Yare, between Norwich and Yarmouth, to deal with the crop of the present year. Great interest is being taken in the movement in high quarters. It is stated by Mr. G. L. Courthope, M.P., President of the Sugar Beet Council, that the Anglo-Netherlands Corporation is a British Company. They are in a position to contract to purchase crops on good terms. In fact, the present state of the sugar market enables them to submit in their initial contract the most handsome prices yet offered in this country—23s. a ton for clean roots delivered at the Cantley factory, or 21s. a ton on railway truck within 15 miles of the works. The Company propose to supply the best seed available, and, if desired, will undertake its sowing. This is satisfactory reading; and upon it is the information that the Great Eastern Railway Company announce that they will use their earnest endeavours to do all possible to forward the movement, both in the way of sidings and carriage rates for the beet.

Road-Surfacing by Tar.

There is extending recognition of the fact that tar is a road preservative as well as an abater of an awful nuisance. It is well known that the powers of the Road Board really cease at road improvement; and the question has already been raised as to how long the Board will regard tar-surfacing as an improvement, and not as a matter of maintenance. But County Councils are hoping that they will receive still larger grants for the purpose from the Road Board, as the continuous increase in the stream of motor traffic means larger expenditure on upkeep—an expenditure not always attributable to local conditions. It may, we think, be taken that, the revenue of the Road Board being largely derived from taxes paid by motorists, the Board will not deal in any narrow spirit with this question; and beyond this, through the preservative character of tar, there is no doubt that still larger economies in other directions will in future be effected in connection with the maintenance of roads. The matter was alluded to at the last meeting of the East Sussex County Council by Mr. Godwin King. He said the Committee are proposing to spend this year £10,380 on road-tarring, against £7400 last year; and of this sum the Road Board have promised to contribute £2500. In his opinion, the tar treatment will have to be continued as long as motor cars exist, or until some better method of keeping down the dust has been devised. A "better method" will have to be one that will not only prevent dust clouds, but will have to exceed the power of tar to waterproof road surfaces, and maintain them in a sound state under the triturating process of modern traffic.

A Black Outlook.

There is only about a fortnight to run before the notices of the coal miners expire; and things to-day are in a critical state. The national conference of colliery owners and miners' representatives was abortive last week; and though neither side professes to be desirous of a stoppage, neither side is prepared to give way on the question of a minimum wage. The miners will not recede further from the revised district scales of minimum wages recently published; and the owners will not accept the principle of a minimum wage. This being so, really little blame for the deadlock can be attached to the South Wales owners for withdrawing from the conference last week. South Wales appears to be a sort of live volcano in the situation. The men, notwithstanding the frequent interruptions of work of late years through disputes, are still anxious for war; while the owners have before them the agreement with the men that does not expire until 1915, but which to-day is not valued at anything more than waste paper. It is not to be wondered at that the masters have lost faith in the men honestly abiding by any agreement into which they may now enter. The Miners' Federation are meeting to-day to consider the general situation; and a meeting of the Industrial Council has been called by the Board of Trade for Wednesday. The position in the coal trade is bound to be a matter for the consideration of the latter. It is hoped that there will be a happy issue out of the present—we wish it were possible to write with confidence the word "temporary"—*impasse;* but the hope has little to sustain it at the moment. Meanwhile other countries are busily competing for the British export trade, in connection with which Mr. Corbet Woodall, in his address at the meeting of the Gaslight and Coke Company, expressed the opinion that, if hostilities should unfortunately break out in the coal trade, the Government should assist in protecting home requirements by for a time re-imposing the coal tax on exported coal.

PERSONAL.

The Directors of the Grays and Tilbury Gas Company have appointed Mr. WILLIAM FREDERICK WHITTAKER, as Secretary, in place of Mr. H. C. Borradaile.

We are pleased to learn, from the current number of the "Journal des Usines à Gaz," that M. RENÉ MASSE, the Manager of the Société d'Eclairage, Chauffage, et Force Motrice (the Company supplying most of the Paris suburbs), has been made a Chevalier of the Legion of Honour.

From the applications sent in for the position of Engineer and Manager of the Hawick Gas Company, three were selected as being the most suitable; and at a meeting of the Directors last Friday, Mr. J. D. KEILLOR, of Ardrossan, was selected. Mr. J. D. LUCK, a collector, was appointed as Assistant-Manager.

Mr. HERBERT J. CARPENTER, draughtsman and engineering assistant to the Harrow and Stanmore Gas Company (son of Mr. Samuel Carpenter, the Engineer of the Dorking Gas Company), was married on the 31st ult., at West Hanningfield Church, to Miss Cordelia Trembath, daughter of Mr. W. D. Trembath, a well-known farmer in Essex.

Many readers of the "JOURNAL" are aware that Mr. WILLIAM ARNOTT, the Manager of the South African Lighting Association at the Cape, is on his way to England for a holiday. Before starting, he was presented, on behalf of the staff of the Association, with a case of engraved gold links and a silver-mounted umbrella. Mr. Sterley, in making the presentation, spoke of the high esteem and respect in which Mr. Arnott was held by the staff, and the good feeling which had always existed between them. They wished him *bon voyage* and a safe return.

It will doubtless be noticed, from the report of the proceedings at the meeting of the Gaslight and Coke Company last Friday, that two changes have recently been made in the staff. After service extending over forty-seven years, Mr. JOHN WILTON, who for more than half this period was Engineer-in-Charge at Bow Common, has retired, and is succeeded by Mr. W. B. REIDIE, the Engineer of the Barking Company, recently amalgamated with the larger undertaking. Mr. Iago's recent death caused a vacancy at Shoreditch; and it has been filled by the promotion of Mr. A. H. SOLOMON, the Chief Assistant-Engineer at Beckton.

OBITUARY.

Mr. JAMES HENRY SCHOLFIELD, J.P., of North View, Whitworth, a Director of the Whitworth Vale Gas Company, died somewhat suddenly at his residence on Friday at the age of 68. It was only on Wednesday, at the half-yearly meeting of the Company, that he was re-elected a Director—a position he had held for a great many years.

The death occurred on Thursday last of Mr. W. D. CRUDDAS, the Chairman of the Newcastle and Gateshead Water Company. Up to about a fortnight ago, deceased, who was in his 81st year, was able, though in indifferent health, to transact business; and he attended a Board meeting of the Water Company. He afterwards took a severe cold, and complications set in to which he succumbed. His father was associated with Mr. (afterwards Sir William) Armstrong in establishing the Elswick works, of which he became Financial Manager. On his death, his second son, Mr. W. D. Cruddas, succeeded to the position.

The death occurred on Sunday of Mr. JOSEPH MANWARING, of Manor Road, Brockley, and late of No. 46, Cannon Street. He had reached the age of 84 years, and was very well known to the last generation of gas engineers, having been for a great number of years the London representative of the Birtley Iron Company and the Pelaw Main Collieries. At the time of his death, he was Chairman of the Ascot and District Gas and Electricity Company, the Whitchurch and District Gas Company, Limited, the Hungerford Gas Company, Limited, and the Soham and District Gas Company, Limited. In Masonic circles, he will be remembered as a Past-Master of the Evening Star Lodge. The funeral will take place at Brockley Cemetery at 2 o'clock on Friday.

"Transactions" of the Institution of Gas Engineers.

We have received the "Transactions" of the Institution of Gas Engineers for the past year. The volume contains a full report of the proceedings at the annual meeting held in Glasgow in June, under the presidency of Mr. Alexander Wilson, M.Inst.C.E., the Corporation Gas Engineer and Manager. The papers, with the report of the discussions, have all appeared in the "JOURNAL." Noteworthy features of the volume are the records of the proceedings at the conference held in the spring of last year on the publicity question, and of the subsequent formation of the British Commercial Gas Association, the constitution and rules of which are given. The contents, as usual, include accounts of the visits and social functions connected with the annual meeting; abstracts of papers published in various chemical journals from July, 1910, to June, 1911; lists of the officers, council, committees, and members of the Institution, and the officers and committee of the Benevolent Fund; and notices of the work of the members removed by death. The volume, which has for frontispiece a portrait of Mr. Wilson, has been produced under the editorship of Mr. Walter T. Dunn, the Secretary of the Institution.

ELECTRICITY SUPPLY MEMORANDA.

The "Tricity" Apostle Declines—What He Has Not Told Us—An Authority on Gas Pressures in Relation to Cooking-Stoves—Abnormal Conditions for General Application—The Open Challenge—Will it be Accepted?—Cooking and Heating Views, Wise and Otherwise.

WE invited, through our issue for Jan. 23, Mr. F. S. Grogan, one of the exponents of the art of cooking in "Tricity" electric-ovens, to explain in these columns certain statements (some of which, from our knowledge and experience of cooking in gas-ovens over five-and-twenty years, we knew to be untrue applied generally); and he has, in our view with exceedingly bad grace and bad taste, declined to come into our columns. He has a letter in the "Electrician" for Feb. 2 purporting to be a reply to the comments made in the "Memoranda" on Jan. 23, but in which "reply" he guardedly avoids the main points upon which we wished to obtain the grounds on which he relies for support. He must, any man of intelligence must, agree with us that the points for which he has made himself responsible should be capable (if true) of easy substantiation; but he evidently refuses to substantiate them in any way, but by what in these days of scientific means for obtaining proof of actualities must be regarded as the most amateurish methods that are open to all sorts of error, and by vague postulation. And what is just as bad, he apparently claims that his own personal observations, within the narrow field of his own experience, are sufficient for him to pronounce a universal condemnation upon the gas-oven. That is neither judicious nor judicial. More on these points presently. Here is the reason of Mr. Grogan for not coming into our columns. He says: "I much prefer to avoid such explosive surroundings, and remain in the cleaner atmosphere of the 'Electrician.'" That is neither polite, nor a sufficient reason. It is certainly not courageous. He who, with these words, daubs the immaculate columns of the "Electrician" with abuse upon us, charges us in his letter with having devoted to personal abuse the chief part of our criticism of his former letter. We will not say whether we agree with or deny his allegation. What we wrote on Jan. 23 is open to the inspection of all our readers—gas and electrical men—and their fair judgment between ourselves and Mr. Grogan will be sufficient for us. But we will say this, that our criticisms were not directed to Mr. Grogan personally, but to his views and statements on definite matters. There is we hope, for our friend's sake, a distinct difference between the individual and the other things. If the "Electrician" had quoted our comments *in extenso*, its readers would have seen precisely their nature, and ascertained for themselves how far Mr. Grogan has answered them.

It will be remembered that this gentleman owned to being the author of the statement that the relative temperature efficiencies of gas and electric ovens were 12 and 80 per cent. We invited him to tell us the type of gas-cooker he used in making the test, and the methods he adopted in ascertaining the so-called heat efficiencies, in order that we might see whether they were of a scientific character and worthy of credence. What does he say in reply: "My tests were carried out over several years on different makes of gas-stoves, all of which were hired out by gas companies at a rental of 2s. or 3s. per quarter. The tests were taken on commercial cookers under practical working conditions in the kitchen, and are not theoretical laboratory results." We ask electrical engineers, who boast of their scientific training, whether Mr. Grogan's answer is a sufficient one, or one that can give them any confidence in the temperature efficiencies that he quotes. We care not whether the tests were made in the kitchen or in the laboratory; all we require are the names and sizes of the stoves used, and a detailed statement as to the methods adopted in ascertaining the efficiencies, and it would be useful to know the towns where they were made. Are we asking for anything beyond what is fair? Mr. Grogan puts the efficiencies forward as "conclusive" and as a "complete answer" to the claims made for gas-ovens. They cannot, without full knowledge as to their bases, be acceptable to any intelligent man. We said before, and we say again, that if the author of these efficiencies will show us the foundation for the figures, we will frankly say whether or not they are "conclusive" or a "complete answer."

Then we come to the point as to the poisonous fumes. What the Tricity cooker advocate said was that when cooking with a gas-oven, "the escaping heat, poisonous fumes, and smell give the person using a cooker a headache." What a number of headaches there must be in the country every day, and how the same persons who use gas-cookers daily, and sometimes several times a day, must find the disorder a chronic one! Strange to say, with all our long experience, we have not come across this state of affairs. It has been left for Mr. Grogan to inform people that they are suffering from headaches through the gas-oven, though they may not be aware of the fact that they have a headache. It is truly remarkable that it has taken all this time for this to be discovered, and that the honour of the discovery should have fallen upon Mr. Grogan. Stranger still is it that the use of gas-ovens, under such circumstances, should have increased to such numbers; strange, under such circumstances, that the use of the gas-oven should still be extending in the manner that it is; strange, under such circumstances, that these headachy people should continue to use them. But we asked Mr. Grogan to take a gas-oven, and to put names to the poisonous fumes and quanti-

ties. What does he say to this? "I am asked to give a name to the poisonous fumes, &c. Where is the necessity?" The necessity arises from his own public proclamations. We have in the gas-oven free burning bunsen jets; and we press Mr. Grogan to state what are the poisonous emissions from them of which he speaks and their quantities. Why be ambiguous, if he is dealing merely with demonstrable facts? We again urge him to give a proper answer. If it is not forthcoming, then electrical engineers may measure-up for themselves the statements of their self-constituted champion, and the value of his efforts, in attempting to cultivate business in electric cookers, by maligning the gas-oven. The "Electrician" calls this letter by Mr. Grogan "a spirited reply to the 'JOURNAL OF GAS LIGHTING.'" Where is the "spirited reply" to our question as to the methods of ascertaining temperature efficiency and to our inquiries in regard to poisonous fumes? We fail to find it in one case or the other.

Then we come to the point as to pressures. Mr. Grogan says that in his tests he has used a water-gauge coupled to the "main" pipe of a gas-cooker just above the oven-tap, which is the means for reducing or increasing consumption. He states that he has made these tests over lengthy periods, and the limits were from 5-10ths of an inch to 4 inches of water. "Is not this an increase of pressure," he asks, "of 700 per cent.?" In London, too, he says he has made pressure tests over 24 hours; the variations found being 6-10ths of an inch to 5½ inches of water, or over 800 per cent. increase of pressure. It is an unkind Fate that has given Mr. Grogan these experiences. He is (we are not surprised) quite prepared "for the gas man to retort that had the gauge been coupled to the main from the street, this variation would not be observed; but I am dealing with the practical case of a gas-cooker working in the kitchen as fixed by gas companies." This being so, it is pretty conclusive evidence that the gas-pipes in the houses in which Mr. Grogan's experiments were carried out were not of a suitable size for the work to which they were put—that they were put in for lighting only without sufficient margin for other uses. One can overload the gas-pipes of a house, just as much as one can overload the electric wiring of a house. There are a large number of electrically lighted houses in which, if the "Tricity" cooking outfit were installed, it would be imperative for additional wiring to be carried out. We are not so foolish as to suggest that all gas-cookers are properly installed, and have proper pipe connections; but there was never a time when there was greater uniformity in the pressures in the distributing mains than there is to-day. We are not so foolish as to allege that, with the 100 per cent. growth of gas consumption in twenty years, local weak spots in regard to pressure have not arisen in areas; but there never was a time when there were better means than now, and when the means are being adopted, of rapidly applying the remedy. We ask Mr. Grogan and the "Electrician" to consider the conditions in relation to the distribution of electrical energy. Our electrical friends are no more immune from pressure variations owing to local conditions than we are; and unfortunately for them the variations often extend throughout entire supply areas. We have known a not inconsiderable amount of trouble to arise from variations of voltage. Mr. Grogan says that he wonders how gas engineers would manage with restrictions of electricity supply which has to be maintained, under penalty, to within 2 per cent. up or down from the declared pressure. Is this general, Mr. Grogan? Who are the testing authorities? And do they carry out their duties? It would be rather interesting to take part in stirring up some of them to a proper sense of their public responsibilities.

It may be generally taken that the normal condition is an ample supply of gas at a good pressure, and that is found in practically every district. Where it does not obtain, it is an abnormal condition, and needs remedying, and is capable of remedy. Where there is a good normal district supply, if a gas-oven is not properly furnished with gas, then the house piping requires attention. But one cannot justly take abnormal conditions and local defects, and clothe them with the right to universal application. Again referring to 25 years' experience in gas cooking, in four different gas-supply areas, there has been no trouble with gas-cookers through variations of pressure, and without the use of a governor. For years past we have had small governors fixed to gas-fires in a house where the whole of the heating for sixteen years has been by this method; and there is not the slightest trouble through variation of pressure. One other point. In his first letter, Mr. Grogan says the cook, using a gas-oven, has to watch carefully *all the time*—seemingly suggesting that the pressure, during the space of time that the oven is in use for cooking a meal, is fluctuating up and down in a most sprightly fashion. It would be interesting to know how, he thinks, this peculiar see-sawing of pressure occurs. Yet still more interesting would it be to learn how he accounts for the gas-oven, with so many vagaries and defects as he pictures in hyperbole, gaining in popularity.

Our readers will have noticed from our "Correspondence" columns that Mr. R. G. Marks, of Southport, has challenged Mr. Grogan to a public contest to determine the practical relative efficiencies of the gas-oven and of the electric-cooker; but the Editor of the "Commercial" Supplement of the "Electrician" has attempted to make certain paltry excuses against accepting the challenge. First of all, he sneers at Mr. Marks' condition that both he and Mr. Grogan shall work with brand-new cookers, and says that this condition is put forward "for obvious reasons from the gas point of view." We do not know what our omniscient friend means by this; but it is readily understood a brand-new cooker and heating elements would be an advantage with electricity. However, Mr. Marks meets the point by saying that, if preferred, he will use the old gas-cooker from his kitchen. The same omniscient one appears to think that Mr. Marks knows nothing about cooking. The challenger was brought up as a baker and confectioner. However, the opinion of the electrical writer is a very good reason why Mr. Grogan should close with Mr. Marks. Then the same cooking-expert writer in the "Electrician" says that Mr. Marks "may possibly be interested to learn that all the articles of food referred to [in Mr. Marks' challenge] could not possibly be cooked satisfactorily in any single oven at one and the same time." This is another opinion that serves as an excellent reason why Mr. Marks' challenge should be accepted by Mr. Grogan. All the things named can easily be cooked satisfactorily in a gas-oven, by the use of Mr. Marks' meat-roaster, while the meat is being baked. But we can quite believe that they cannot be in the bath of steam found in a "Tricity" cooker while meat is baking. Then the electrical writer has the brilliant idea that the challenger selected a large hall for the demonstration because there would be a large gas-main connected to the cooker there. Mr. Grogan can see that an ordinary pipe from the hall fittings supplies the oven; and the oven can be connected up with a gas-meter. The electricity used must also be metered. There is such a thing as efficiency in the matter of oven capacity, taking a gas-oven and an electric-oven of the same cubic capacity. The "JOURNAL" has nothing whatever to do with Mr. Marks' challenge. We have never seen him; and therefore have not witnessed his cooking with gas-ovens. But we have in daily use his devices, and would not be without them. However, though we have not instigated or had anything to do with the challenge, as Mr. Grogan hints that he is accustomed to making tests of the calorific value of gas by the Junkers' calorimeter, we will arrange to have one present at the contest (if he agrees to accept it), so that he can for himself make, in the presence of the gas and electrical men there, a test of the calorific value of the gas with which the cooking in the gas-oven will be done. But about the large hall business. Mr. Marks, in his innocence, thought Mr. Grogan, being so cock-a-hoop over cooking by electricity, would have jumped at the idea of having a large place with gas and electrical engineers present as witnesses of his triumph and Mr. Marks' vanquishment. However, the accommodating Mr. Marks changes the venue for the gas part of the test to his own kitchen, if Mr. Grogan prefers to go there, and have every-day conditions for the gas-oven. Now, Mr. Grogan, show your courage and the depth of your convictions, by accepting the challenge as put forward by our correspondent. Such an opportunity ought surely not to be missed by one who has admirably shown us so many wonderful things——with such very shallow foundations.

The electrical papers are just now fairly teeming with this question of heating and cooking; and we are pleased to see that all electricians are not so fatuous that they are unwilling to acknowledge facts. There is Mr. G. C. Allingham who, writing to the "Electrical Review," states that he has to have his meat cooked by gas or coal; and he does not find it dried up or toughened. Another correspondent "F. R. C." boldly asserts that for general heating purposes, electricity is only for the rich; no one else can afford to keep a unit radiator going fourteen or fifteen hours a day for each room in such cold weather as has recently been experienced. For water heating, he finds a "Califont" gas water-heater will give a continuous supply at full bore of a ¾-inch tap; and the cost averages 17s. to 20s. per quarter for a household of three persons with frequent visitors, including 2s. meter-rent and gas at 2s. 10d. This correspondent makes the wise and expressive remark, "even the devil should be given his due." On the subject of room-heating, Simplex Conduits, Limited, have been sending round a description of a new type of electric radiator; the descriptions in one paper and another have so much in common that the single origin of the matter is easily traceable. This radiator has a small supply of water in a vessel above the lamps; for it seems that Simplex Conduits have arrived at the conclusion that electric radiators dry the air of rooms, and that an artificial supply of humidity is required to adjust matters. If this is not done "an unpleasant feeling is caused in the mouth, and there is produced a general sensation of depression." Electricity Publicity Committee please copy. In the description, some wonderful doings are ascribed to the coal fire. It "needs a constant supply of oxygen for combustion, and consequently takes from the atmosphere the essentials for breathing. . . . Obviously, therefore, a constant supply of air has to be arranged; and the air of a room changed at a higher rate than with electric heating, and this causes draughts." That is to say, the coal fire selects the oxygen, and unkindly leaves the oxygen-denuded air in the room—the air is not, according to electrical science, all drawn into the fire, because "a constant supply of air has to be arranged," owing to the wicked robbery that goes on, and for which Nature has apparently not provided. We were under the impression that change of air in rooms was rather a healthful proceeding; but it appears in these days, according to electrical ideas, the smaller the change the better. This is a bad thing for the ventilating fans; but the secret lies in the low heating capacity of the electric radiator. There is no doubt as to the meaning of the electrical scientists as, it is said, "with electric heating, there is no impoverishment of the atmosphere by loss of oxygen." Again, "it is important to remember that with electric heating the air is not *depleted* of its oxygen." This makes strange reading; and the electrical papers have printed it.

QUALITY OF LONDON GAS LAST YEAR.

A Correction of the Calorific Power of the South Metropolitan Company's Supply.

In the article, on "The Quality of London Gas in the Year 1911," which appeared in the "Journal" last week (p. 351), it was stated that on one occasion, in the fourth quarter of the year, the South Metropolitan Company had a result of 110·2 calories per cubic foot net calorific power. It was remarked that the minima reported for other weeks of the quarter for this Company were generally higher than those for the other two Companies, while for this one week its minimum of 110·2 was considerably lower. The latest summary to hand of the testings, issued by the London County Council, contains a foot-note stating that the testings for calorific power at the Lewisham Road testing-place on the 16th, 18th, 19th, 20th, 21st, and 26th of December, 1911, "are withdrawn, as the calorimeter was found to be out of order during the period in question." The following alterations should, therefore, be made in Table II. and Table V. of the article in the last "Journal:"

South Metropolitan Gas Company.	Gross Calorific Power.	Net Calorific Power.
Minimum for the fourth quarter	134·9 instead of 124·4	119·7 instead of 110·2
Minimum for the whole year	133·5 instead of 124·4	119·0 instead of 110·2

The discarding of the results obtained during the period referred to will also raise to a slight extent the average calorific power for the fourth quarter, as given in the "Journal" summary; but the correct average can be exactly deduced only if the County Council publish corrected averages for the Lewisham Road testing-place for the two weeks in which the faulty testings occurred.

THE FORWARD POLICY.

Illustrations from Tottenham and Edinburgh.

Generally speaking, we see throughout the gas industry activity in stimulating the day load of gas undertakings; but here and there patches of inertia are to be found. This is a pity. However, those administrators who allow old-fashioned notions to abide with them, and continue in lethargic mood, have only to blame themselves if they permit a large part of the opulent field for industry and trading to slip from among the opportunities that are theirs. It has to be recognized, as a starting-point, that two factors have come into play in connection with the lighting business. They are now so old that we feel it is almost ludicrous to introduce them here, excepting that it is necessary for completeness of argument to drive home the truth. The one is that, since the advent of incandescent gas-burners, there has been a succession of improvement in their efficiencies and adaptability; and this has meant more light for less consumption of gas. The other factor is that electric lighting has also been vastly improved in the matter of efficiency; and the competition has cut away from the gas industry some of the consumption for lighting purposes that would otherwise have remained with it. The prepayment gas consumer has come in to fill up—in some cases completely, in other cases not quite—the gaps in the lighting load occasioned by the simultaneous birth of these two opposing forces to large rate progress in lighting. It is also true that the high-pressure system of gas lighting has come along, and is enabling the gas industry to occupy a prominent place in street, shop, factory, and such-like lighting. We are stronger to-day than ever in the lighting field in the matters of economy, efficiency, and reliability, and in offering a matchless all-round servant. But, with the growth of our strength, the electricity industry is wider awake than ever to the necessity of adopting still more generous measures to take possession of new lighting territory. They offer all sorts of inducements to win custom. They wire houses free, and adopt divers modes and agencies to secure fresh business, with which modes and agencies the local gas undertaking sometimes only comes into contact when a nice fat piece of business has been transferred. It is necessary to keep abreast of this sort of thing; and to make the most of the advantages that the gas industry possesses.

In this matter of lighting and in that of cultivating the day load, a forward and liberal policy must be, if it has not already been, adopted. The character of districts, of course, varies considerably, and has influence in the matter of result. Some are less exposed than others to competition; but where the strongest competition lies, there must the greatest activity prevail. As an illustration of what can be effected, though the illustration is not held up as being a singular one, reference may be made to the Tottenham Company. The Company have had a glorious rate of expansion; and the Board and officials pursue a robust policy in their relations with the consumers, doing all manner of work to keep them pleased and satisfied with the service rendered. In the address of Mr. Corbet Woodall to the proprietors as published last week, he made a remark which shows the broad views he holds upon this subject. "The amount of money expended," he observed, "in thus benefiting the consumers is equivalent to a considerable charge per 1000 cubic feet; but I am satisfied that the result is worth to us at least as much as would be a reduction in the price of gas of the same amount." The business and the economies have grown with such persistency that the price is now 2s. 2d. per 1000 cubic feet. What do we find there as the result of this policy? The Company are making a house-to-house investigation in their area. It was referred to last week, but bears alluding to again. Up to the end of the year, 170 streets, containing 10,970 houses, had been examined. The results recorded were that in 26 per cent. of the houses ordinary meters were connected, and in 66 per cent. coin meters, while 5 per cent. were found unoccupied. Out of these approximately 11,000 houses, there were only 27 consumers of electricity; and of these 25 were using gas for cooking and heating. The average consumption per consumer is ascending. These are the results of a forward policy that is spread over every branch of a gas undertaking's business. We know there are some gas administrators who say: "Let us look after the lighting business; and the cooking and heating business can well look after itself." Others, on the other hand, say: "Let us develop the day load, and leave the economies of gas lighting to protect that business." Both are wrong. In every department educational work, and the promulgation of the knowledge of the advantages and conveniences of gas, are required, and satisfaction of the consumers has to be assured. Up to a point, cooking and domestic and industrial heating by gas will advertise themselves; but inducements to adoption with people habituated to a certain course of life and methods are necessary beyond.

We cannot understand the short-sightedness of those administrators who do not recognize these elementary essentials in developing competitive business; we cannot understand those administrators who allow their business to show more than temporary shrinkage due to adverse atmospherical conditions, through reluctance to adopt a liberal forward policy. We have had some long reports from Edinburgh in a recent issue of the "Journal" and again to-day, dealing with a retrogression of consumption in the area of the Edinburgh and Leith Gas Commissioners; and when we look at the considerable amount and nature of the recommendations made by Mr. W. R. Herring (the Consulting Engineer), Mr. A. Masterton (the Acting Engineer), and Mr. A. Canning Williams (the Treasurer), these recommendations tell us, as plainly as anything can, that the Commissioners have not hitherto pursued a liberal and forward policy for the purpose of cultivating the day consumption. The average progress of the gas industry is represented in 100 per cent. increase in the past twenty years; and in several places in England, the day load is now equal to the night load. And this day load makes all the difference per unit of output to many of the charges upon the undertaking. But the Edinburgh and Leith Gas Commissioners appear to have hung back; and now they are face to face with the absolute necessity of moving to supplement their business. But there seems even now a good deal of indecision over the matter. A Sub-Committee, as is seen to-day, p. 453, have put forward recommendations that do not go so far as their experts advise; and it appears fairly obvious that the Commissioners as a body are reluctant to go even so far as the Sub-Committee. It is hoped we are mistaken; and that the reference back means that the Commissioners would like a still more progressive policy framed in the matter of cultivating the day load. The feeling, however, as to the reason for referring the matter back inclines in the other direction.

From experience of success in the day business in the Southern part of England, we are confident the Sub-Committee in their recommendations are trying to obtain too much from the appliances, and are putting too many restrictions in the way of free development. Gas consumers do not like conditions. They are obstacles to be shunned; and, indeed, as a rule the variety of business done irons-out the necessity for stipulations. The Sub-Committee suggest a rent equal to 2½ per cent. on the cost of cookers, with free fixing. So far, there is no objection to this; but then they propose the condition "with a guaranteed consumption by the hirer, to be adjusted later on." A guarantee is an obstacle. Why not make the simple reservation that, if it is found that the cooker is not sufficiently used, the Commissioners reserve the right to remove it? Then as to gas-fires, why limit them to three years' hire purchase (the hire including 10 per cent. on the purchase price)? Why not let the fires out on simple hire at a price that will embrace initial cost and maintenance, without trying to make a profit out of them?

It is a question of selling gas, and making the profit from this source of business. Gas-fires and other appliances, from the point of view of the gas administrator, are only means to an end—and that end is the sale of gas. The same argument applies to high-pressure and other lighting installations. There is a proposal to abolish rent for gas-meters used for gas-engines and special trade purposes. That is a mistake. Those meters may only be kept as stand-bys to private gas plants or electric power. The abolition of meter-rents does not foster consumption the same as a reduction in the price of the commodity, the sale of which the Commissioners are supposed to be strongly desirous of encouraging. Regarding the counsel of Mr. Masterton under the head of publicity, if we understand the recommendations of the Sub-Committee correctly, they are averse to the suggestion that the Commissioners should become subscribers to the British Commercial Gas Association. If this is so, we are sorry. With the Glasgow Gas Committee before us on the one hand and the Edinburgh and Leith Gas Commissioners on the other, we regret the room for comparison, but there is truth in the statement that the former are to-day taking a more spirited and progressive

course than the latter. We would rather have been able to write —we hope it will be possible to so write in the near future—that they are running a neck-and-neck race in a forward commercial policy.

WATER BILLS FOR 1912.

In preceding issues of the "JOURNAL," the principal features of the Gas Bills and Provisional Orders for the session which will open to-morrow have been indicated. It remains to deal with the measures relating to water supply; and we take first those promoted by companies.

It is proposed to incorporate the Bawtry and Tickhill Gas and Water Company, for the supply of gas and water in certain parishes in the West Riding of York and the county of Nottingham. The gas portion of the Bill was noticed in the "JOURNAL" for the 9th ult. (p. 78); and the water section does not call for comment at any length. The limits of supply are the urban district of Tickhill, and the parishes of Austerfield and Bawtry in the West Riding of York, and the parish of Harworth and five others in Nottinghamshire. The Company propose to construct a well and pumping-station in the last-named parish, a reservoir in the urban district of Tickhill, and three connecting pipe-lines; and they require five years within which to complete them. The charge for water will be based upon the rateable value of the premises supplied. It will be 8s. 8d. where this is less than £5 per annum, and range from 9 down to 5 per cent. for higher values, with an additional charge for every closet beyond the first and for every fixed bath. The rate for meter supplies is not to exceed 1s. 6d. per 1000 gallons, with a minimum charge of 10s. per quarter; and 1s. per 1000 gallons is to be the maximum charge to any local authority. The Bill contains provisions for the supply of water in bulk and for the making of bye-laws for the prevention of waste. As previously mentioned, the capital of the proposed Company is to be £25,000, with borrowing powers to the extent of one-third. [*Parliamentary Agents: Messrs. Baker and Co.*]

The Dunstable Gas and Water Company are applying for parliamentary sanction for certain existing water-works, authority for the construction of others, and power to raise additional capital. The existing works referred to comprise a well and pumping-station, with a reservoir, &c., in the parish of Dunstable; and the new ones proposed consist of another pumping-station, an adit or adits connecting it with the present wells, a service reservoir, and a conduit between the new pumping-station and the old reservoir. The Company require five years for the completion of the works. They propose to raise additional water capital to an amount not exceeding £15,000, to be limited to a dividend of 7 per cent. per annum if issued as ordinary, or 5 per cent. if as preference capital, unless a larger amount is needed to make up previous deficiencies. Power to borrow to the extent of one-third of the original capital existing at the time of the passing of the Act, and in like proportion as regards the additional capital, is required; as also authority to create debenture stock. The interest on borrowed money is restricted to 5 per cent. [*Parliamentary Agents: W. & W. M. Bell.*]

The Staffordshire Potteries Water Company have promoted a Bill to enable them to construct additional works, extend their limits of supply, and raise more capital; and they also apply for the confirmation of existing works. Taking the latter first, they consist of a pumping-station in the parish of Norton-in-the-Moors, an aqueduct or pipe-line connecting it with the existing Brown Edge reservoir in the same parish, and another running from it to an enclosure, together with all incidental pipes, filters, works, and apparatus. The new works are to be rather extensive. They comprise two pumping-stations, to be situated respectively in the parishes of Eccleshall and Draycott-in-the-Moors, both in the county of Stafford, a service reservoir in the parish of Swynnerton, and six aqueducts or pipe-lines. Periods of seven and fifteen years are required for the completion of these works. The Company wish to extend their limits of supply so as to include part of the western portion of the parish of Checkley. Additional capital to the amount of £180,000 is applied for, to be limited to 7 or 5 per cent. according as it is ordinary or preference, with borrowing powers to the extent of one-third; and the Company ask for authority to create debenture stock. The Bill contains a provision to the effect that if the owner, lessee, or occupier of any lands within a mile on either side of two of the pipe-lines comprised in the new works proposed to be carried out makes a request in writing, the Company are to supply him with water for domestic purposes at a rate not exceeding 7½ per cent. per annum on the rateable value of the premises to be supplied, and for other than domestic purposes at 1s. per 1000 gallons. [*Parliamentary Agents: Messrs. Batten, Proffitt, and Scott.*]

A Bill has been promoted to incorporate the Sutton and Mablethorpe Water Company, and to confer powers upon them in connection with the supply of water. The capital is to be £12,000, in £5 shares; and powers are sought to borrow to the extent of one-third and create debenture stock. The Company's limits are defined as the urban district of Mablethorpe, and several specified parishes in the county of Lincoln. It is proposed that the Company on the one hand and the North-East Lincolnshire Water Company or the East Coast Company on the other may enter into agreements for the supply of water in bulk to the Company. The charges for water are to be based on the rateable value of the premises supplied. They are about the usual figures—starting at 8s. 8d. per annum with extras. Not more than 2s. per 1000 gallons is to be charged for a meter supply. Provision is made for the transfer of the undertaking of the East Coast Company to the new Company, at a price to be agreed upon or settled by arbitration. Portions of the district of the North-East Lincolnshire Water Company are to be transferred to the Mablethorpe Company. [*Parliamentary Agents: Messrs. Baker and Co.*]

In the "JOURNAL" for the 23rd ult., the gas portion of the Bill of the Swanage Gas and Water Company was noticed. With respect to the water portion, the Company require authority to construct additional works, comprising a well and pumping-station in the parish of Arne, three adits, a service reservoir to be situated in the parish of Corfe Castle, and two aqueducts or pipe-lines; and they ask for five years within which to complete them. Confirmation is sought for the construction of a well at Durlston, the water from which is to be used only when it is absolutely necessary to do so to supplement the supply; and as soon as the Company obtain from the new works not less than 250,000 gallons of water daily throughout the year, the water from the well named is not to be longer supplied. The use of another well, situated under the premises of the Company at Swanage, is to be discontinued. The charge for water is to be based upon the rateable value of the premises. Where this does not exceed £5 per annum, it is to be 8s. 8d.; above £5, it is not to be more than 10 per cent. of the rateable value. For every closet beyond the first, the Company wish to be authorized to charge up to 7s. 6d., and for a 50-gallon bath not more than 12s., per annum. Authority is required to raise additional capital to the amount of £45,000, to be entitled to 7 or 6 per cent. dividend according as it is raised as ordinary or preference, with borrowing powers to the extent of one-third. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The Tendring Hundred Water Company are applying for an extension of their limits so as to include the parish of Dedham, in the rural district of Lexden and Winstree, and the parishes of Wrabness and Little Bentley, in the rural district of Tendring; also for confirmation of the construction of a well and pumping-station near Manningtree, and of an elevated tank near Frinton-on-Sea. The Company likewise want power to make new works, consisting of a well and pumping-station at Dedham, a water-tower in the parish of Wix, and four aqueducts or pipe-lines; and they ask to be allowed seven years for their completion. The Bill, if passed, will confirm the acquisition of certain lands in the parishes of Dovercourt, Great Oakley, and Tendring; and the Company will be able to use them for the general purposes of their undertaking. They will also have power to purchase additional lands; but the total quantity held must not at any time exceed 40 acres. Authority is sought to raise additional capital to the amount of £120,000, to bear a maximum dividend of 8 per cent.; to borrow to the extent of one-third; and to create debenture stock. [*Parliamentary Agents: Messrs. Rees and Freres.*]

The Bill promoted by the Windermere District Gas and Water Company is to obtain authority to raise more capital and to construct additional works. The sum of £7500 is named as the maximum amount required, inclusive of premiums; and it is proposed to issue it in shares of the nominal value of £10 each. The dividends specified are 7 and 6 per cent. respectively for ordinary and preference capital. Borrowing powers to the extent of one-third of the issued capital are sought, as well as authority for the creation and issue of debenture stock. The new works specified are an impounding reservoir, the enlargement of an existing reservoir, three conduits or pipe-lines, two roads, and the diversion of the stream known as Dubbs Beck, on which the present reservoir stands, and on which the new one will be constructed. The Company require five years for the completion of these works. [*Parliamentary Agents: Messrs. Speechly, Mumford, and Craig.*]

Institution of Mechanical Engineers.

In the report of the Council of the Institution which will be presented at the sixty-fifth annual general meeting on Friday, it is stated that on the 31st of December last the total membership was 5828, of whom 2550 were ordinary and 2533 associate members. At the corresponding period of 1910, the total was 5700. The revenue for the year was £15,922, and the expenditure £12,295; leaving a balance of £3123, exclusive of entrance fees amounting to £454 and a life composition of £50 carried direct to capital account. In the course of the Inaugural Address of the President (Mr. E. B. Ellington) at the opening of the session, he referred to qualifications which should be possessed by mechanical engineers; and the Council have had under consideration for some time the question of entrance examinations for the younger applicants for admission to the Institution. They are of opinion that the time has come for instituting such an examination; and their suggestions are contained in an appendix to the report. They are followed by a note on the subject by the President, with a view to the full discussion of the matter at the annual general meeting. The Council mention that Professor F. W. Burstall's report on a new series of gas-engine tests, varying only the ratio of air to gas and the composition of the charge during expansion, is on the point of completion. In February, 1913, the award will be made of the Water Arbitration Prize (of the value of about £30) for the best original paper dealing with new investigations of hydraulics, or recent developments in the application of water power, accepted by the Council for publication, with or without discussion, in the "Proceedings" for 1911-12.

THE QUENCHING OF COKE.

Allen and Gibson's Patent.

Among the patent specifications issued last week was one describing a process for "the manufacture or treatment of coke or like carbonaceous fuel and in apparatus therefor," the invention of Mr. Edward Allen and Mr. Ralph E. Gibson, of Liverpool. The patent is No. 29,189, and is dated Dec. 15, 1910. The complete specification was not, however, accepted by the Patent Office authorities till the 15th ult.

In their introductory remarks, the patentees say: When the process of carbonizing coal or other material has been completed (whether it be conducted in retorts, as in the manufacture of coal gas, or in chambers or ovens, or otherwise), the most usual plan has been to discharge the incandescent coke into the open air, and quench it by throwing or sprinkling water upon it, or by immersion of the coke in water, or by passing steam through it. This process of quenching produces large quantities of steam, smoke, and dust, with intense heat—thus causing considerable discomfort to workmen; and, furthermore, the coke gets saturated with, softened, and damaged by, the water, which it is impossible to wholly get rid of afterwards, although it is a matter of commercial importance that the coke should contain as little water as possible. It is scarcely necessary to remark that when coke is required to produce its maximum calorific effect, it should be as dry as possible; and the present invention has for its object certain improvements relating to the production or treatment of coke or like carbonaceous fuel, so that it shall contain no water, or only such water as it absorbs afterwards from exposure to an atmosphere saturated with a certain proportion of water.

The usual practice hitherto has been to discharge the coke into the open air and then quench it with water, which system (it is said) possesses seven disadvantages: (1) The coke is broken in its fall and forms a quantity of breeze; (2) the partial destruction of the coke, by combustion, takes place through contact with atmospheric air; (3) the coke becomes saturated with, and damaged by, water, which is never wholly got rid of, and which, while adding to its weight, reduces its calorific effect; (4) the coke is disintegrated by the sudden application of cold water; (5) large quantities of flame, heat, smoke, steam, and dust are produced—causing considerable discomfort to the workmen engaged in discharging and quenching; (6) the water used in quenching is entirely lost—either passing off as steam, or becoming absorbed by the coke, or even if part of the surplus water is recovered, it has to be freed from coke dust before it can be used for most purposes; (7) the heat of the incandescent coke is absolutely wasted, and is not utilized at all.

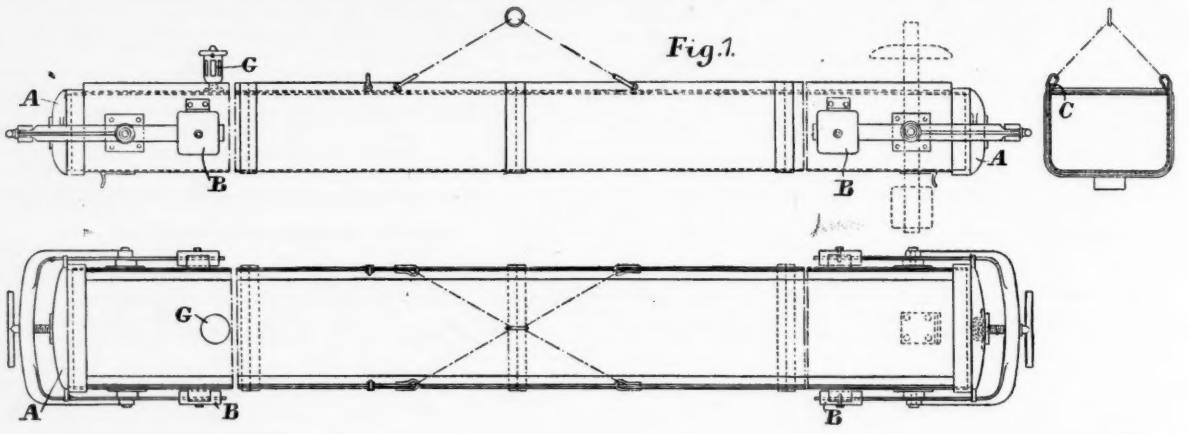
Recognizing these defects, especially the last, it has been proposed to remove the coke before cooling directly from the oven by a forcing ram or drag into a chamber having an outside water-jacket, and utilizing the heat given off by the incandescent coke for the purpose of generating steam, which steam, being stored in the top of the jacket, was subsequently discharged into the coke within the chamber to cool it. Apparatus of this character was a very unwieldy contrivance, as the water-jacket and steam space were to all intents and purposes a steam-boiler, which had to be made of great strength to withstand the steam pressure, and was provided with the usual mountings—water-glass, pet-cocks, feed-valves, safety-valves, stop-valves, blow-off cock, manholes, and mud-holes. The doors of the chamber, moreover, were not air-tight; so that combustion of the coke would not entirely be prevented. Other suggestions have also been made—viz., filling the hot coke into boxes open at the top and closable by a lid, which had the defect, already pointed out, that the coke was broken in its fall, and air had free access to the coke until the box was filled and the lids closed down on top.

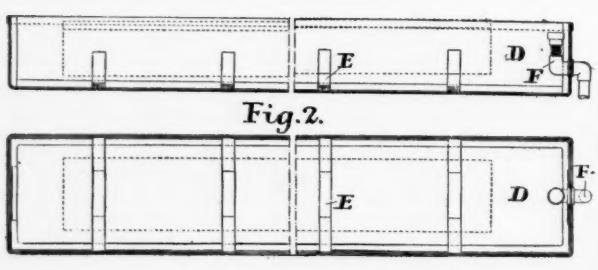
It has also been proposed in connection with coke-ovens with bottoms which can be dropped into a sloping plane, so that the charge will slide off by gravity when the angle reaches a sufficient inclination, to deliver the coke charge into boxes or reservoirs, which, when filled, were closed, to keep it from contact with the atmosphere. By this proposal, the coke, slipping down the inclined plane into the box below, would be broken by its fall, and air would have free access to the coke until the box or reservoir was filled and closed.

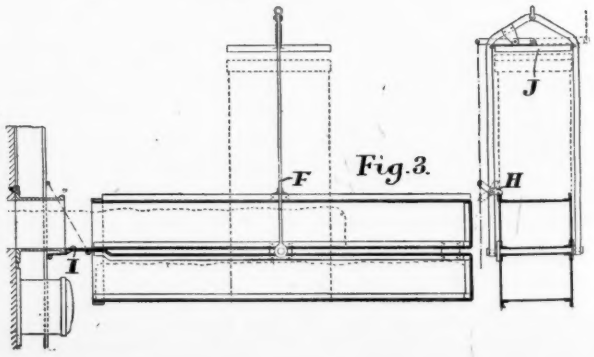
These defects are what the present invention is designed to avoid; and the patentees express the belief that they are the first to produce a workable apparatus by which the incandescent coke from any retort or oven where it is produced can be directly charged in an unbroken condition into the interior of an open-ended box substantially without it coming into contact with atmospheric air so that the absence of air prevents combustion taking place. The apparatus has the distinguishing feature that the incandescent coke, &c., is charged in an unbroken condition directly into the interior of an open-ended box substantially without it coming into contact with atmospheric air, and then, when filled, the box is instantly tightly closed, so as to keep the hot coke out of contact with the atmosphere—this having an important influence upon the quality of coke produced. Consequently, no combustion of the coke can take place. To hasten the quenching, the closed box, with its contents, is immersed in water, or has its outside subjected to a cooling fluid; but no steam or water has access to the interior of the box.

Fig. 1 is an elevation of the box, with a plan and cross section. Fig. 2 is a longitudinal section and plan of the bath with the box immersed in it. Fig. 3 is a longitudinal and cross section of another form of box presented to the door where the coke is.

In fig. 1, the long box is shown, which, by means of a trackway, is moved endways right up to the doorway of the retort. A convenient arrangement is to provide lifting tackle suspended from a trolley running on an overhead trackway, to which tackle the box is coupled by a ring and suspension chains. The end of the box has a door A, which, when open, is presented to the doorway where the coke is; and the whole of the coke is discharged into the box by (say) apparatus of the pusher type, so as to get the coke into the box in one coherent mass without breaking it. The door is made with a faced joint to fit against the end of the box, which is also faced, and is clamped in position by a screw (coupled







to the door) threaded through a bridle the two arms of which are mounted on pivots on the box. The door is also supported by guides on the bridle, which is provided with counterweights B, so that the weight of the door and screw is counterbalanced. Hence, by tightening the screw by its handle, the door is closed tight against the open end of the box, or, by unclamping the screw, the bridle and door swing clear of the box ends, as shown by the dotted lines. The top of the box is provided with flanges C to form a channel for the purpose hereafter mentioned. Brackets (not shown) are fixed to the retort mouthpiece to give support to the end of the box and to keep it in the correct position during the operation of filling the box.

The box being filled with coke, the door at the filling end is closed, and (with the hot coke inside secured from contact with air) is moved by the overhead trackway to the water-tank D (fig. 2), which has a stream of cold water circulating through it; and into this tank the loaded box is lowered by the tackle. The tank has bearers E inside, on which the box rests in a sloping position; and these bearers are inclined at the sides to guide the box into a central position. F is an overflow from the tank to allow water to flow out, while maintaining the water at a given level. Water is fed into the channel formed by the flanges C at the top of the box by a pipe (not shown), and flows down it into one end of the tank—the box being almost, but not entirely, submerged. The water returns round and under the box to the opposite end, where it overflows through the pipe F. The doors A, being clamped in position, prevent access of water or air into the box, while allowing any accumulation of extreme pressure to blow through the joints, or through a relief valve G fixed on the top of the box.

When the cooling of the coke has been completed, the box is lifted from the tank by the tackle, and transported (by trackway) to the place of storage. Here it is opened by removing one or both of the doors, and tilted so that the unbroken coke in a "coherent mass" slides out. Thus it is said to be possible to "produce a perfectly dry coke with a minimum of breakage"—coke "harder and of better quality, with little or no small coke or breeze, and the destruction of the coke such as takes place by combustion, when air is allowed to come into contact with it when hot, is reduced to a minimum."

In some instances (when space is limited), it may not be possible to present so long a box to the doorway where the coke is, owing to the retort-house not giving sufficient space. In such cases, it is proposed to make the box in two lengths joined together one above the other as in fig. 3, with a space between for the circulation of the cooling fluid. The box is suspended from a trolley on an overhead trackway by a yoke pivoted to the box at mid-length. The yoke is provided with a catch H adapted to fall into engagement with a notch in the top of the box, so as to keep the box at right angles to the yoke and so hold it horizontal, and with one or other of its compartments in line with a door of the retort. I is a bridge-piece or platform arranged in front of the discharge opening, and on the same plane as the bottom or floor of the retort, adapted to bridge the gap between the compartments of the box and the retort opening and support the end of the box when in position, so as to enable the coke to be pushed direct into the compartment. The bridge-piece is hinged to swing downwards out of the way of the retort-lid, when the bridge-piece is not in use. When the lower compartment has been filled, the box is lowered, and the upper compartment is filled, or *vice versâ;* the catch H being then disengaged from its notch, and the box swung into the vertical position shown by the dotted lines, so as to come under the lid J, which can be lowered on to the end of the box. The box is then raised, transported, and lowered by tackle into an upstanding tank through which a current of cold water is caused to flow.

PETROL AIR GAS AS AN ADJUNCT TO COAL GAS.

By William Key.

We have received a communication from Mr. William Key, of Glasgow, arising out of the information regarding the working of Mr. Charles Carpenter's system of reversible condensers, as described to the London and Southern District Junior Gas Association—see the "Journal" for the 30th ult., p. 281.

Mr. Key writes: I have always approved of an outlet temperature from condensers of 50° and even 60° Fahr. In the early seventies, on visiting the Manager of the Dunfermline works (Mr. M'Kenzie), I was surprised to find the condenser outlet temperature permitted frost to show on the outside of the last pipes. On discussing this with him, he maintained that the gas should be cooled to the same temperature as the air; but to this I expressed grave objections. Nearly a quarter-of-a-century ago, and while the gas-works under my care were carbonizing about 2000 tons daily, producing 24-candle gas, on one particular occasion when the outlet temperature of the gas passing through the scrubbers was under 40° Fahr. a drop of 12 per cent. in illuminating power occurred; but after having the condensers freed from the greasy, soft, tarry deposit, and removing the patented materials from recently remodelled scrubbers, the usual quality of the gas was restored.

During a lifelong watchful attention to condenser-outlet temperatures, on occasions when the temperature came down to 40° Fahr. and under, the falls were always accompanied by a reduction of illuminating power. I considered this was brought about by the gas scrubbing along cold tarry surfaces, and to the affinity these have for the light hydrocarbons. This is avoided by Mr. Carpenter's system of passing the gas at 140° alternately through the condensers from opposite ends. By so doing he maintains the inner surfaces free from bulky tarry accumulations and the condensers in an efficient condition; but so far as I can make out, he does not accomplish anything more than this.

To alter the existing plant of a gas-works so as to obtain these desirable results means an expenditure of more capital than an alternative suggestion which I now make. No alteration of present condensers is required, while all the year round these will be maintained in a condition of efficiency. The inner surfaces will remain as free from tarry deposit as when a high temperature is applied to them. In large works, the additional plant would repay its cost within three months by the volume of gas it would generate. "Centenary" rotary petrol air-gas generators, capable of producing from 10 to 20 per cent. of the total gas production of the works, occupying a very small space, may be driven by a small steam-engine similarly to rotary washers, and produce the gas cold, which would be distributed by connections through the covers of each hydraulic main. These plants may be belt-driven from the shaft of an exhauster; and the smaller sizes, up to 2000 cubic feet of gas per hour, may be driven by simple valveless hot-air engines using their own gas and requiring no attention beyond maintaining a supply of petrol to the small semi-rotary feed-pump.

Coal gas does not "carry" through the ramifications and long distances of street-mains, whereas my experience is that petrol air gas does carry through miles of mains to the most distant district—even under conditions of 17° of frost to which the holders and shallow mains were subjected. The mantle lights at the extremity of the supply continued to have a brilliance of great intensity. Further, while the supply was a coal-gas one, drips on the mains during winter required to be pumped at least fortnightly; whereas during over three years while under a petrol air-gas supply, no drip required attention—on removal of the caps, the gas blew up from the drip-boxes.

Petrol air gas does not possess a high calorific value; but we know Professor Lewes maintained before the Institution of Gas Engineers in the year 1903* that: "In arguing upon the effect of the calorific value upon the light emitted by the mantle, it seems to have been generally overlooked that it is the intensity of the flame which will be the important factor, and not the calorific value of the gas employed." One gallon of ·715 sp. gr. petrol spirit at 60° Fahr. gives 150 cubic feet of vapour, having a B.Th.U. value of 157,000 units; 1000 cubic feet of petrol air gas produced from 1 gallon has a net value of 157 B.Th.U. per cubic foot; and 1500 cubic feet of gas per gallon gives a net value of 104·7 B.Th.U. per cubic foot. In cold, frosty weather, it is more advantageous to generate the gas from spirit of ·680 sp. gr. A much greater volume of gas is obtained, and it leaves no residue.

A small gas-works in Scotland has for the past seven or eight months been using a 10 per cent. mixture of petrol air gas, produced cold and mixed with coal gas. It is introduced through the cover of the hydraulic main. A recent test of the gas during ordinary lighting hours, as supplied to one of the consumers in the village, and while the gas-works holder was exposed to frost, gave a net value of 625·30 B.Th.U. per cubic foot. This is an instance where at least a 20 per cent. mixture of petrol air gas should, I maintain, have been in use. In a test of this gas for durability—by a Lowe jet photometer, under 9-10ths pressure—a 7-inch flame consumed 2 cubic feet per hour. Glasgow gas by the same apparatus required 11-10ths pressure to give a 7-inch flame, and consumed 2·5 cubic feet of gas per hour. It was stated in the "Journal" for Dec. 19 last that the "Paris authorities require the gas company to supply gas of a net calorific value of 492 B.Th.U. per cubic foot."

The benefits to the small coal-gas works which the manager claims to have secured by the use of the petrol air gas are:

Production of this gas without expenditure of labour.
Considerable addition to productive capacity of works.
Clearing condensers and connections from tarry deposit.
Only one-sixth of the lime formerly used was required.
Five-sixths of the labour on the purifiers saved.

The following is a theoretical calculation of the benefit to be obtained in a comparatively small gas-works (Dolgelly) by the introduction of petrol air gas, and without taking into consideration the saving of lime and labour by revivification, &c.

Annual Make of Gas.	If 20 per cent. P.A. Gas Used.	Cost for Petrol at 1s. per Gallon.	Cost for Plant.	1,068,000 Cubic Feet Sold at 4s. 6d.*	Profit after deducting cost of Plant and Petrol.
5,098,000	1,068,000	£53 8 0	£90 0 0	£240 6 0	£96 18 0

* Present price, 5s. 3d. per 1000 cubic feet.

Some considerations, other than that of gas production, are:

1.—The gas entering the hydraulic main dry and cold will tend to reduce the volume of aqueous vapour reaching the condensers.

2.—Prevention of naphthalene from taking its crystallized (snow) formation.

* See "Journal," Vol. LXXXII., p. 769.

3.—The ceasing to draw atmospheric air into the mains after the gas has been mechanically clarified, with its accompanying danger of causing rust encrustations within plant between the air-meter and purifiers, with sulphur combinations therewith, and so apt to ignite spontaneously, causing explosion when portions of the plant are opened to the atmosphere.
4.—Revivification of lime in purifiers.
5.—Purifiers do greater duty, or less purifier area is required.
6.—Removes tarry and oily deposits from street mains.
7.—Increases capacity of works, free of cost.
8.—Occupies very little space, and requires little attention.
9.—Residuals from purifiers when removed are odourless.

It will be observed that purification by oxide of iron has not been mentioned, nor its revivification by the process, which it is so capable of doing. This is owing to my not having made tests with oxide.

I am prepared to place a plant capable of producing 2000 cubic feet of gas per hour in one gas-works within easy distance of Glasgow by rail, free of charge, in order that data may be obtained by close observation. Thermometers to be placed through the casings at each tray, and the temperatures, volumes passed, duty performed by each purifier while in rotation, and percentage of the adjunct in use, to be recorded.

NEW GAS-WORKS AT RIO DE JANEIRO.

A RECENT issue of the "American Gaslight Journal" contained an article by Mr. L. J. Carder descriptive of the new works which have been erected by the Société Anonyme du Gaz de Rio de Janeiro. The following are some extracts from the article.

The works were planned not only to produce gas for the supply of present needs, but to meet the demands consequent upon the rapid growth of the city. They were built on made-land; the entire area on which they stand having only a few years ago been covered by water. By virtue of their new contract with the Government, the Company took possession of the tract at the beginning of 1910, and immediately began to put in the foundations for the buildings; using in all cases piles and reinforced concrete necessitated by the unsettled character of the ground. The Company's Chief Engineer (Dr. H. B. Harrop, formerly of Milwaukee) visited England, Germany, and the United States, in order to study the newest methods in use in all the largest gas-works, and to select the most modern equipment for those of his Company. The result is that they contain the latest types of plant, and may be regarded as among the most complete gas-works in the world.

The Company is one of the subsidiary Companies of the Rio de Janeiro Tramway, Light, and Power Company—a group of public utility companies, operating in foreign countries, controlled by Dr. F. S. Pearson, of New York City, London, Toronto, and other places; and the latest of the Company's rehabilitation projects is that of the gas plant above referred to, which was completed last July. The old works, constructed about sixty years ago, were enlarged as circumstances required; but they were totally inadequate to the necessities of a great and growing city. The old plant was worked and the new plant built under the direct supervision of Dr. Harrop, with the assistance of the writer of the article and Mr. W. E. Watson, both formerly with the Brooklyn Borough Gas Company, and Mr. H. A. Church, formerly in the New York office of Dr. Pearson.

The retort-house is of the latest type, and equipped with Dessau verticals, comprising four batteries of seven benches of ten 16-feet retorts, or 280 of the latter, equal (with steaming) to a total capacity of 4,200,000 cubic feet per day of 24 hours. The water-gas plant has a total daily capacity of 2,800,000 cubic feet. This added to the coal gas make brings the maximum daily output to about 7 million cubic feet, which is nearly double the present daily output. The coal will be handled mechanically throughout, from ship to retort. Coke conveying and handling machinery, also entirely automatic, is of the accepted type for verticals. The principal consideration in selecting the vertical type was the necessity for dispensing as far as possible with manual labour.

The other plant includes primary and secondary condensers, tar-extractors, exhausters, tower scrubbers, washers, &c., complete for dealing with 7 million cubic feet of gas per day. There are four double-deck cylindrical purifiers, equipped with side charging and discharging doors, and built in the open, according to the design of Dr. Harrop, to meet the varied conditions peculiar to Rio de Janeiro.

The new four-lift holder has a capacity of 3 million cubic feet, which, added to the existing outlying holder capacity in the city, will give a total storage of 5 millions. The ground space is laid out for extensions in all directions.

The new high-pressure distributing system was more particularly the work of Mr. Carder. The entire daily output will be dealt with by motor-driven compressors, divided into three units, each of 200,000 cubic feet hourly capacity. One, two, or three units may be employed to compress to any pressure between 10 and 30 lbs. that is found to be the economical one for any volumetric condition between low consumption hours and the peak load. Gas is delivered into a system of high-pressure mains, radiating to main distributing points in the city, and bisecting the old low-pressure feeders, into which the gas is discharged at consumers' pressure through Reynolds district governors. These high-pressure arteries, by means of Reynolds line regulators, deliver gas at 1 lb. to 5 lbs. pressure into the old transmission trunk system between the old works and the outlying holders; thus employing the latter as a subsidiary pressure system, which in turn is also connected into consumers' mains at various points with regulators. By means of small diameter branch lines, any low-pressure city area can be reinforced. Holders are connected to the subsidiary pressure mains by regulators operating automatically.

The high-pressure pipes are Messrs. Stewarts and Lloyds inserted joint pipe and Mannesmann weldless steel tubes throughout, in 20 to 33 feet lengths, bell and spigot, with lead wool joints, specially constructed drips at all low points, cast-steel bell and spigot and flange specials, and flanged high-pressure valves; all pipes and fittings being re-covered on the spot, before laying, with jute cloth and hot asphalte, all bottle-tight at 100 lbs. pressure.

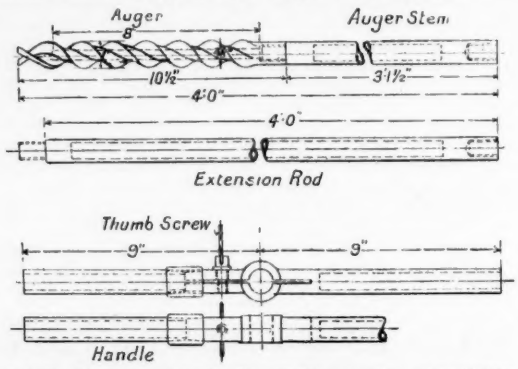
As a whole, the combined manufacturing and distributing plants provide great flexibility of operation, and will permit of indefinite extension.

SPONTANEOUS HEAT IN COAL PILES.

THE following article on the above subject appeared in the "Iron and Coal Trades Review" for the 2nd inst.

Everyone who has to do with coal mining or with the utilization of coal knows the danger of spontaneous combustion which exists when piles of coal are stacked in the open; and in this connection it is often important to ascertain quickly and accurately the temperature of the inside portions of such a pile. A method which has been in fairly common use for this purpose is to drive a pipe down into the interior of the pile, and to then lower into the interior of the pipe, to ascertain the temperature at the end, either a maximum-reading thermometer, or else a low-temperature pyrometer with electrical connections. This method, however, is open to the objection that there is certain to be a circulation of air in the thermometer well thus formed, carrying away a proportion of the heat; and thus the true maximum temperature within the pile is not ascertained.

A method which has been developed by Messrs. Arthur D. Little, of Boston, employs a special auger as shown in the following illustration. The most commendable feature is the boring or tip section shown in the upper left-hand corner of the diagram. The thermometer well is of the proper diameter to take the regular maximum thermometer used in clinical work. For the first measurement of piles of coal in which a particularly high temperature is surmised, instruments reading up to 500° Fahr. are used; but for intermediate readings a complete set of thermometers, properly calibrated, and ranging from 200° to 500° are desirable.



Details of Instrument for Testing the Temperature of Coal Piles.

In making temperature measurements with this apparatus, up to five 4-feet lengths are usually employed in connection with the tip and handle. Before connecting the tip with the first length, a small ball of asbestos or glass wool is placed in the bottom of the thermometer well to prevent the breakage of the glass parts. The thermometer is then dropped into the well, and borings are made to the desired depth. It is advisable to make a drawing of the pile showing the exact locations of the measurements both in plan and elevation; and it is found in practice that consistent readings can be obtained in the same spot by allowing the thermometer to remain at a fixed depth for about ten minutes in order to ensure proper transfer of heat through the walls of the tip. By means of this appliance, it is claimed that far more satisfactory results are obtained than by the usual method. In point of fact, it is stated that measurements taken by the method here described show temperatures 30° to 40° higher than those obtained by the pipe method, due to the fact that there is absolutely no circulation of air at the thermometer well.

The Blackpool Town Council, by a unanimous vote, have decided to confer the honorary freedom of the borough on two of the members, of whom one is Alderman John Bickerstaffe, J.P., the Chairman of the Flyde Water Board, who is the "Father" of the Council, having been a member since 1880.

RELATION OF MODERN ROAD SURFACINGS TO FISH LIFE.

By W. J. A. Butterfield, M.A., F.I.C., Assoc.Inst.C.E.

[Extracts from a Paper submitted to the Institution of Municipal and County Engineers, meeting in London last Friday.]

In introducing his subject, the author remarked that questions have frequently arisen of late in regard to the effect of surface washings from roads on the fish life in the streams, ponds, or rivers into which the washings ultimately pass. The materials used in the construction and maintenance of roads, and their methods of employment, have changed in most districts in recent years, while, where the old methods of maintenance have been retained, various compositions have been applied to the surface of the roads with a view to suppressing dust in dry weather. It has been frequently alleged that the new methods and materials have resulted in pollution of the surface washings of a nature which has been responsible for the death of fish in adjacent waters into which the washings have passed. Opinions as to the fairness of these allegations have been expressed with a partiality and an assurance worthy of firmer foundations. The ascertained facts as to the effects of different road surfacings on the composition of the washings and of the effects of the latter on fish life have hitherto been very few. The object of the investigations described in this paper has been to collect more definite data, on which it will be possible for those interested in road construction and maintenance, as well as all who are interested in the saving of watercourses from pollution, and in preserving fish life in rivers and lakes, to form a judgment which will have some trustworthy basis. It will, doubtless, be necessary from time to time to enlarge our knowledge in this respect by further investigation in a like direction; but the results reported in this paper should suffice to enable fairly reliable deductions to be drawn in regard to the effect on fish life of the materials which are used for road treatment at the present day.

Dealing first with the water-bound macadam road, Mr. Butterfield next proceeded to consider the value of sea water and calcium chloride as dust-abating materials, and then offered the following remarks on

Bituminous or Tarred Surfacings.

The application of tar and bituminous materials to country roads was initiated with a view simply to abating dust. Among the early materials of an oily or bituminous character which were tried were preparations of petroleum and blast-furnace tar. But the application of these materials has since passed into relative insignificance compared with the use of coal tar, and latterly of certain natural bitumens and asphalts. Originally the intention underlying the employment of coal tar, other tars, and oils, &c., was to bind the particles constituting the road surface together by a semi-plastic and essentially non-brittle material, and, in the event of the particles being torn asunder, to have their pores so filled by a heavy liquid or semi-solid that they would remain in suspension in the air only for a very brief time. The employment of these materials with this object resulted, however, in the discovery that they serve another purpose, which is of far greater ultimate importance—viz., that of prolonging the life of the road surface and thereby, *cæteris paribus*, reducing the charges for road maintenance. It may now quite properly be said that tar and similar materials are applied to road surfaces primarily with the object of maintaining the road, and that the advantage of dust abatement which they afford is only incidental to their employment for maintenance.

The surfacing of roads with tar and similar materials, if properly carried out, results in the outer layer or skin of the road being rendered waterproof; and so long as this skin remains intact, water cannot penetrate to the underlying road material. The extent to which the tar which is applied for the coating or painting of road surfaces penetrates below the surface depends on a number of factors, among which may be named the nature of the road material, its degree of consolidation, and the viscosity of the tar on application. To whatever extent the penetration of the tar may vary according to the varying conditions of its use, it is only the surface layer or skin of the coating of tar which can affect water which falls or stands upon it, because so long as the coating is sound, the water is prevented from penetrating the surface layer. On this account the quantity of tar applied to a road surface is less material in regard to the pollution of watercourses than is the extent of surface covered by the tar. The ultimate dispersion of the whole quantity of tar by attrition will in any case be spread over so long a period that it is unnecessary to regard it as having any serious bearing on the pollution of watercourses.

The question therefore to be considered is to what extent water impinging with the force of the heaviest rainfall on a tarred surface, or water standing on such a surface (from which it may happen not to drain away quickly) may become polluted by such contact with the tarred surface. Probably the most serious risks of pollution of water occur during a drizzle or long-continued rainfall which at no time is heavy, as in that case the water will remain for a comparatively long period in contact with the tarred surface before draining from it into watercourses. These considerations apply to normal conditions. Cases may, however, occur in which a heavy storm, with a rush of flood water, following very shortly after tar has been applied to a road, will be attended by the actual lifting away and removal of the tar itself while it is still soft and not consolidated with the road material. In this case the tar may be carried bodily into watercourses; and the question of the extent to which it will pollute the water therein has to be considered. The degree of pollution will be determined by the proportion of the tar so carried into the watercourse to the total volume of water therein, and by the extent to which the tar and water are agitated together by the movement of the water.

After some remarks on pitch and asphalt macadam, Mr. Butterfield dealt with the nature and composition of tar and pitch, natural asphalts, &c., and then considered the

Effect on Fish Life of Different Components of Coal Tar.

Ammoniacal Liquor and its Ingredients.—Gas liquor ordinarily contains about 0·2 per cent. of phenols; the amount increasing to a maximum of nearly 0·4 per cent. in liquor which has been deposited, or otherwise brought into intimate contact, with tar, and decreasing to a trace in liquor from the last washing plant on the gas-works. The "volatile" ammonia consists of free ammonia, ammonium sulphide, and ammonium carbonate; the "fixed" ammonia, chiefly of ammonium sulphocyanide (thiocyanate), ammonium ferrocyanide, ammonium thiosulphate, ammonium chloride, and ammonium sulphate. Table I. shows the effects on fish

Table I.

Salt.	Parts of Salt per 1000 Parts of Water.	Equivalent Parts of Ammonia, Free or Combined, per 1000 Parts of Water.	Minutes which Elapsed before Death.	
			Gudgeon.	Dace.
Ammonia	1·00	1·00	1·5	..
,,	0·10	0·10	6·0	2·5
,,	0·02	0·02	130 100 100	100
,,	0·0148*	0·0148	60	..
,,	0·01	0·01	720	1800
,,	0·004	0·004	(a)	(a)
Ammonium sulphocyanide	0·10	0·0227	360	(a)
,, ,,	0·01	0·0023	(a)	..
Ammonium sulphate	1·0	0·257	60	60
,, ,,	0·1	0·026	(a)	(a)
Ammonium sulphide	1·0	0·500	105	†
,, ,,	0·1	0·050	(a)	(a)
Ammonium carbonate	1·0	0·354	180	..
Ammonium chloride	1·0	0·318	360	..
Ammonium ferrocyanide	0·1	0·024	(a)	..
Ammonium thiosulphate	0·1	0·023	(a)	‡
	Vols. of 10-ounce liquor per 1000 vols. of water.§			
Gas liquor	1·00	0·0217 (exclusive of fixed ammonia)	105	100
,,	0·92	0·0200 ,,	110	105
,,	0·10	0·0022 ,,	(a)	..

(a) Unaffected.

* Experiment reported by Dr. Gardiner.

† Tench died in 260 minutes.

‡ Tench unaffected.

§ 10-ounce strength by direct titration, and therefore exclusive of the fixed ammonia present.

of solutions of these salts of ammonia of different strengths. The strengths of the solutions are stated in parts by weight of the salt in 1000 parts of water—*i.e.*, in grammes per litre; but in another column the calculated proportion of ammonia contained in the salt is also shown. A result reported by Dr. J. E. Gardiner in his evidence in a case of alleged poisoning of fish by gas liquor has been interpolated.*

It will be seen that free or real ammonia is very deadly to fish; and next to it come (in order) the sulphocyanide, the sulphate, the sulphide, and the carbonate. The sulphocyanide and sulphate are not present in large proportion in gas liquor, the effect of which will, however, vary slightly according to its composition, which depends on the point in the train of condensing and ammonia-extracting plant on the gas-works from which it has been obtained. The results for a typical sample of liquor are shown in the table, and indicate that it is nearly as deadly to fish as is water containing the equivalent amount of ammonia wholly in the free state.

But, in addition to ammonia and its salts, gas liquor contains, as already stated, a certain amount of phenols, solutions of which, if above a certain strength, are deadly to fish. The presence of phenol in gas liquor may, however, account for it being considerably more deadly to fish than are solutions of carbonate and sulphide of ammonia of the same ammoniacal strength. Other salts of ammonia are only of minor importance, though it should be noted that the sulphate, which is largely used as a

* See "Journal," Vol. CXVI., p. 627.

fertilizer, is more deadly than most of the other fixed salts of ammonia.

Tar Oils and their Associated Bodies.—The tar oils have to be considered from two points of view—viz., as oils which, by forming films or otherwise, may interfere with the proper aëration of water, and as solvents or carriers of other substances which are directly poisonous or harmful to fish. The lighter oily constituents of coal tar—viz., the oils distilling below about 170° C.—have generally a lower specific gravity than water; and therefore if, in a free state, they enter watercourses, they will spread over the surface, and form a film which will cover a very large area of water. It is difficult to judge the precise harmfulness of such a film in preventing the proper aëration of water, but evidently running water in which the surface is continually being broken, will be less affected than still water. Even with such water, however, if oil is present in substantial quantity, its effect in soothing troubled waters has to be borne in mind.

An attempt to ascertain experimentally if a film of the light oils from coal tar was directly harmful to fish was made by pouring one part of crude light oil on to 1000 parts of water and putting gudgeon in the latter. The gudgeon died in three hours. [See Table II.] There is evidence that mineral oils are nearly as good solvents of oxygen as water, so that the aëration of water does not appear to be inhibited by a film of mineral oil. Experiments were made on gudgeon with gasoline and a heavy automobile mineral lubricating oil, applied to water in the same proportion (1 to 1000) and in the same way as the crude light oil. The gudgeon were unaffected by the film either of gasoline or lubricating oil. In regard to the crude light oils of coal tar, however, it may be pointed out that they act as solvents of phenol and other toxic ingredients of tar, and are not simply neutral oils. The film-forming power of coal tar depends chiefly on the proportion of light oils in it; and it appears that the film of crude light tar oils is rather more deleterious to fish life than the film of mineral fuel and lubricating oils.

The middle oils of coal tar are heavier than water, and will not ordinarily cause an appreciable film on the surface. The effect on fish of water which has been in contact with these oils depends mainly on the amount of tar acids in the oil; but since the oil itself is not appreciably soluble in the water unless specially emulsified (as in commercial "soluble creosote"), the effect is largely influenced by the extent to which the tar acids are extracted by the water on mere contact or agitation with the oil. The heavy oils of coal tar do not contain phenols or other bodies which are known to have any directly poisonous action, or which are appreciably soluble in water.

The effects on gudgeon of water which has been mixed as far as possible with various tar oils in the proportions stated are shown in Table II. Experiments were also made with various pure substances which are contained in, or may be extracted from, the tar oils. The most important of these is phenol (carbolic acid). Pure phenol was dissolved in water in known proportions, and the effects of the solution on fish were observed. The results are included in the table. Similar experiments were made with Calvert's "No. 5 carbolic acid," which consists chiefly of cresols (the next higher members to phenol of the phenol series), and with certain basic bodies derived from coal tar—viz., aniline, toluidine, and pyridine. The results of these experiments are also shown in the table.

TABLE II.

Substance.	Parts of Substance per 1000 Parts of Water.	Minutes which Elapsed before Death.	
		Gudgeon.	Dace.
Phenol	0·210	45	35
,,	0·100	60	60
,,	0·0125	†	†
,,	0·010	(*a*)	..
No. 5 carbolic acid	0·219*	70	70
,, ,,	0·010*	2160	..
Soluble creosote, 2 per cent. tar acids	0·100	90	..
Creosote oil, 14 per cent. tar acids	0·250	180	..
,, 2 per cent. ,,	1·000	240	..
Crude light oil	1·000	180	..
Crude heavy oil	1·000	240	..
Aniline	1·000	40	..
,,	0·100	180	480
Toluidine (ortho-)	0·100	180	..
Pyridine	0·100	(*a*)	(*a*)
Naphthalene	>1·000	(*a*)	(*a*)

(*a*) Unaffected.

* Parts of tar acids, reckoned as phenol, determined by bromine.

† Dace much affected, and gudgeon slightly affected in six hours, when they were returned to fresh water and both recovered.

Pitch.—Coal-tar pitch consists of substances which are relatively inert; and hence it is not surprising that it was found that water in which small lumps of pitch were suspended in a muslin bag proved to have no effect on gudgeon and dace.

Effect of Water which has been in Contact with Coal Tar.

A number of experiments were made in order to obtain direct evidence of the effects on fish life of water which has been in contact with coal tar. The experiments may be conveniently arranged in four series as follows: (1) Tar and water in definite proportions were agitated very vigorously for fifteen minutes at a known temperature, and fish were kept in the extract thus obtained and the effects observed. (2) Tar was placed in the bottom of a vessel, a false perforated bottom was put over it, the vessel was filled with water, and fish were put in the water and the effects observed. (3) The whole inside surface of the vessel was painted with tar, which was allowed a certain time to set, and the vessel was then filled with water, in which fish were put and the effects observed. (4) A large tray was painted with tar, which was then sanded; a spray of water was allowed to fall on the tarred and sanded tray in imitation of rainfall. The washings were then collected and their effect on fish was observed. Approximate determinations of the strength of the extracts and washings in phenolic constituents were made for purposes of control by means of bromine water.

TABLE III.

Distinctive letter	A.	B.	C.	D.	E.	F.
Description of tar	Crude Coal Tar (Light).	Crude Coal Tar (Heavy).	"Freed" Coal Tar (Medium Light).	"Freed" Coal Tar (Medium Heavy).	"Freed" Carburetted Water-Gas Tar.	Scotch Blast-Furnace Tar.
Specific gravity at 15·5° C. (60° Fahr.)	1·160	1·274	1·185	1·208	1·085	1·155
Water, per cent. by weight	5·5	6·2	0·1	0·1	0·3	1·9
Ammonia, grains per gallon of tar	72	58	*Nil*	*Nil*	*Nil*	1·6
Light oils, distilling below 170° C.*	3·0	2·0	0·6	0·2	1·7	0·5
Middle oils, distilling between 170° and 270° C.* (per cent. by weight of the dehydrated tar)	22·0	9·0	23·4	16·1	31·4	23·5
Heavy oils, distilling between 27° and 300° C.* (per cent. by weight of the dehydrated tar)	5·2	1·7	8·8	6·8	13·3	7·7
Pitch (per cent. by weight of the dehydrated tar)	68·6	85·3	66·8	76·8	53·1	67·8
Crude tar acids, per cent. by volume of the middle oils	14·0	<1·0	10·0	5·0	<1·0	35·0
,, ,, ,, ,, tar	3·2	..	2·5	0·9	..	8·6
Free carbon, per cent. by weight of the dehydrated tar	8·5	27·7	15·6	15·8	trace	7·0
Viscosity at 76° Fahr. Time required, in minutes, to flow through an orifice through which refined rape oil in the same conditions flowed in two minutes	2¾	660	10	60	½	43½

* The temperatures during distillation were observed on a thermometer, the bulb of which was opposite the side tube of the fractionating flask.

The majority of the experiments were made on four samples of coal tar, each chosen as typical of a different grade. The composition and general characteristics of these samples of tar are shown in Table III., in which are included the similar particulars in regard to the sample of "freed" carburetted water-gas tar, and the sample of blast-furnace tar on which experiments referred to later were made.

In the first series of experiments, a number of trials were made of agitating tar with different proportions of water at various temperatures. It was found that the phenolic strength of the extract depended on several factors, of which the most influential were the viscosity of the tar at the temperature of agitation, the proportion of tar acids in the tar, and the vigour with which the tar and water were agitated. The effect of temperature seemed to depend mainly on the consequent alteration in the viscosity of the tar. Within a fairly wide range, the phenolic strength was not very greatly affected by the proportion of water to tar, and the extracts of which the effects are reported below were mostly obtained by agitating 1 part of tar with 200 parts of water. A number of experiments were made, however, on extracts obtained by agitating 1 part of tar with 20 parts of water, and on these extracts diluted by the addition of water. Tar which had been extracted by agitation with one lot of water yielded, on agitation with a fresh supply to the second extract, an appreciably lower amount of phenolic constituents than to the first. The effects on gudgeon and dace of extracts of tar prepared by vigorous agitation for 15 minutes of water and tar in the proportions stated are shown in Table IV. The temperature of the water during extraction was 70° Fahr. in all cases but the fifth "C" tar, in which it was 46°.

There are a number of small discrepancies in the table, which may be readily accounted for by uncontrollable differences in the vigour and temperature of agitation, and the variations in the power of resistance of different specimens of the same species

TABLE IV.

Tar Used (see Table III.).	Vols. of Water Agitated with One Vol. of Tar.	Phenolic Bodies reckoned as Phenols in the Extract. Grammes per Litre.	Minutes which Elapsed before Death.	
			Gudgeon.	Dace.
A (crude light) . .	200	about 0·14	15	14
B (crude heavy). .	200	,, 0·06	80	40
C ("freed" light) .	200	,, 0·21	30	20
C ,, ,, .	200	,, 0·17	30	36
C ,, ,, .	200, diluted to 400	,, 0·09	120	31
C ,, ,, .	20 ,, 200	,, 0·02	720	360
C ,, ,, .	20 ,, 200	,, 0 01	1140	360
D ("freed" heavy).	200	—	135	45

of fish. The outstanding feature of the results is, however, that the extracts of crude tars are more deadly to fish than extracts of "freed" tars of corresponding phenolic strength. There is a general agreement in the results with extracts of "freed" tars and solutions of phenol [see Table II.] of the same strength, though the extracts of tar seem slightly more deadly than would be expected from their phenolic strength alone. There is probably some other constituent of the tar extracts which is distinctly harmful to fish life; but until further investigations of the composition of the tar extracts have been made, conjectures as to the nature of this constituent are of little value.

The Effect of Water which has been in Contact with Carburetted Water-Gas Tar and Blast-Furnace Tar.

Experiments were made on a "freed" or "dehydrated" carburetted water-gas tar and a Scotch blast-furnace tar of which particulars are given in columns E and F of Table III. The carburetted water-gas tar, when mixed with water in the proportion of 0·1 part of tar to 1000 parts of water gave a film on the surface of the water, but did not affect gudgeon. The tar, when agitated vigorously for 15 minutes with water in the proportions and at the temperatures stated, gave the results shown in Table V.

TABLE V.

Tar Used (see Table III.).	Vols. of Water Agitated with One Vol. of Tar.	Temp. of Water during Extraction.	Minutes which Elapsed before Death.	
			Gudgeon.	Dace.
		Deg. Fahr.		
Carburetted water-gas tar (E)	20	..	120	..
,, ,, . .	200	70	230	105
Blast-furnace tar (F) .	20	..	20	..
,, ,, . .	20, dil. to 100	..	240	..
,, ,, . .	200	70	25	15

Experiments were made with the blast-furnace tar by agitating it vigorously with water for 15 minutes in the proportions and at the temperatures shown in the table. The extracts were all coloured deep red, and smelt and tasted of the tar. The middle or creosote oils from blast-furnace tar are known commercially as "blast-furnace creosote," and this oil has been used in the preparation of certain compositions sold as dust-abaters. An experiment was made on a mixture of 0·1 part of blast-furnace creosote with 1000 parts of water. Gudgeon put in this water died in 210 minutes.

Effect of Water which has been in Contact with Agricultural Fertilizers.

Experiments were made on the effect on fish life of solutions of two of the best known artificial fertilizers—viz., sodium nitrate and ammonium sulphate—as well as of a solution of lime ("lime water"), the natural drainage from heaps of stable manure, and extracts prepared by agitating water with fresh and old stable manure. The results are shown in Table VI.

TABLE VI.

Substance.	Strength in Parts per 1000 Parts of Water.	Minutes which Elapsed before Death.		
		Gudgeon.	Dace.	Minnow.
Sodium nitrate . .	1·0	(*a*)	(*a*)	..
Ammonium sulphate	1·0	60	60	..
,, ,,	0·1	(*a*)	(*a*)	..
Lime	1·0	20	45	..
,, ...	0·1	(*a*)	(*a*)	..
Stable manure, natural drainage from	Diluted till the yield of ammonia on distillation was equal to 0·2 part	1440	210	135
Do., fresh; artificial extract	0·2 part	..	..	150
Do., old; artificial extract	0·2 part	..	..	about 150

The investigation of these materials was undertaken because it appeared possible that the surface drainage from agricultural land which had been recently treated with the fertilizers named might affect fish life in streams into which it passed, and that injury to fish life really due to fertilizers might be attributed to tarred roads in the vicinity. The effects of the extracts of stable manures were specially studied, because the waterproofing of the road surface by means of tar and similar materials seemed likely to cause more concentrated extracts of horse droppings than formerly to be washed from the road surface into streams.

It appears from the results that there is somewhat greater risk of injury to fish life from the use of sulphate of ammonia than from the use of nitrate of soda, though the fact that the former fertilizer has been applied in enormous quantities for years past, without any definite cases of injury to fish having arisen, indicates that the solution extracted from the treated soil is naturally diluted to an extent which brings its strength below that which has been found by these experiments to be harmful. The same remark applies to the effect of extracts of stable manure. The dilution which naturally occurs before the extracts pass into fishing waters is so great that no injury to fish arises from them. The fact, however, that both artificial and natural manures may, in solutions or extracts of strength comparable with the strength of solutions or extracts of tar and tar products prepared in a similar manner, cause injury to fish has an important bearing on the results which may be anticipated from tarred surfaces, &c., when exposed in natural conditions. It is clear that the concentration obtained artificially is in all cases much greater than would ever occur naturally; and consequently the results with the artificial preparations greatly exaggerate those which can ensue in natural conditions.

Practical Bearing of the Experimental Results.

The results of the more important experiments have now been recorded, with as much detail as has seemed necessary to provide the data on which trustworthy conclusions may be based. The author will briefly indicate some of the conclusions which he draws from the results of the investigation.

1.—That ammonia and many of its salts are very highly toxic to fish, and gas liquor is nearly as toxic as clean water containing the same proportion of free ammonia.

2.—That it follows that the use on roads of coal tar containing gas liquor—*i.e.*, crude tar—is attended by appreciably greater risk of injury to fish life than is the use of coal tar which has been "freed" from gas liquor.

3.—That of the oils contained in coal tar, the "light oils," are the most harmful to fish life; and since the light oils are to a large extent removed from coal tar by the procedure which is followed for the removal of gas liquor, an additional reason is afforded for preferring "freed" to crude coal tar.

4.—That the phenols are highly toxic to fish, though less so than ammonia.

5.—That tars in which phenols and allied bodies ("tar acids") are present in high proportion may render water which has been in intimate contact with the tar toxic to fish in degree approximately corresponding with the amount of phenoloid bodies acquired by the water from the tar.

6.—That, other things being equal, water acquires a smaller proportion of phenoloid bodies from a thick highly viscous tar than from a thin freely fluid tar.

7.—That, taking into consideration Nos. 5 and 6, and the fact that light thin coal tars generally contain a larger proportion of tar acids than heavy thick coal tars, the use on roads of light thin coal tars is attended by appreciably greater risk of injury to fish life than the use of heavy thick coal tars.

8.—That the risk of injury to fish life from the use of "freed" coal tar on roads is negligible, provided the tar contains less than 3 per cent. by volume of crude tar acids, and the area of the tarred surface is not greater than one-twentieth of the total area of ground draining into a watercourse.

9.—That naphthalene and coal-tar pitch are not distinctly harmful to fish life.

10.—That the use on roads of a "freed" carburetted water-gas tar is attended by less risk of injury to fish life than the use of a "freed" coal tar. [The use of "crude" carburetted water-gas tar is, however, inadmissible, owing to the large proportion of light oil in it.]

11.—That the use on roads of blast-furnace tar, or of preparations containing much blast-furnace creosote, is attended by considerably greater risk of injury to fish life than the use of a "freed" coal tar.

12.—That some important natural asphalts and asphaltums and petroleum preparations are not distinctly harmful to fish life.

13.—That the use of salt water or of calcium chloride for dust abating is not attended with risk of injury to fish life.

14.—That there is a remote risk of injury to fish life from washings from accumulations of horse droppings or stable manure, and that the use of sulphate of ammonia as a fertilizer is attended by appreciably greater risk of injury to fish life than the use of nitrate of soda. All the risks referred to in this paragraph are, however, in all ordinary circumstances so remote that they are negligible.

Suggested Provisions for Safeguarding the Surveyor in the Use of Tar.

The conclusions set out above disregard all considerations other than the effect of the materials, &c., on fish life. It is not the purpose of this paper to deal with the other considerations

which enter into the choice of road-surfacing materials by the surveyor; but bearing in mind this limitation, the surveyor may, in the author's opinion, safeguard himself in the use of tar on roads in all ordinary cases, if he uses only coal tar or a mixture of coal tar and carburetted water-gas tar which in either case is (1) of not lower specific gravity at 15° C. than 1·18; (2) contains not more than 1 per cent. of water or gas liquor, the ammonia in which is equal to not more than 5 grains per gallon of tar; (3) contains not more than 1 per cent. of light oils; (4) contains not more than 3 per cent. by volume of crude tar acids.

If cases occur where the washings from tarred roads will not be diluted to at least 20 times their volume before, or immediately on, entry to fishing waters, the maximum limit of water or liquor in the tar should be reduced to 0·2 per cent.; of ammonia, to 1 grain per gallon of tar; and of light oils, to 0·8 per cent. (or 1 per cent. of distillate below 170° C. inclusive of water). As an extreme precaution in certain cases, a tar prepared from pitch and some "dead" tar oil—*i.e.*, middle and heavy tar oils from which the phenols have been extracted—might be employed; and when the market value of carbolic acid, &c., is high, the cost of such a prepared tar should not be much greater than that of an ordinary good "freed" coal tar.

Discussion.

Mr. R. J. Thomas (County Surveyor of Buckinghamshire) remarked that he desired to propose a hearty vote of thanks to Mr. Butterfield for a paper which must be of infinite assistance to those who were bound down by modern traffic to utilize something more than water for binding their roads. The experiments detailed in the paper appeared to him to be most interesting; but he did not think that Mr. Butterfield would say they were entirely conclusive. He supposed they were more in general form than in absolute proportion, because, from what little he had to do with fish, they found very few alike either in temperament or the way in which they would take the hook. It seemed to him (Mr. Thomas) that the whole point lay in the question of cost to the road authorities. He referred to the purchase of distilled tar. This was what it amounted to. Unfortunately, in his county, they had not been able to afford to purchase anything but crude tar. They had used it for something like eight years, doing somewhere about 100 miles a year, and so far they had had no claim at all. He might attribute this to two reasons. One was that they took very great care to screen the tar; and they took a lot of care to boil it at intense heat. In applying it to the road, the object they kept in view was not to leave a film or a skin on the road, but to drive the hot tar as deep as they could into the interstices of the road. By doing this, he had not found any great risk of the escape of any quantity of tar into the road gutters. He was inclined to think this might possibly be why they had not had claims against them. The only occasion it appeared to him when there was any great danger of pollution was, in this extreme climate of ours, when they were busy with five or six machines in different parts of the county, and a heavy thunderstorm came on before the tar penetrated into the road. Then he admitted that they would run very considerable danger indeed of pollution; but he had found that, by concentrating the outlets on the roadside, and having in each of the outlets a filter formed of three grades of gravel reduced finally to sharp sand, they got apparently an effluent which did no harm at all. They had two or three very celebrated fisheries in the county; and the owners (they did not make any complaints), as complaints had been made in other places, suggested it was desirable they should do what they could to minimize any such pollution. They had fallen in with that. By putting in small filter-beds, they had found so far that the owners of the fisheries had been satisfied. As he said before, the whole question was one of cost. He had to buy his tar throughout the county from different gas-works. He believed they bought from at least twenty different gas-works, not one of which was in a position to lay down plant for purifying the tar. Unless they bought from them, it would mean their paying something like three times the price for distilled tar imported from the large Midland towns, or else reduce the area of tarred roadway by two-thirds. This they certainly did not intend doing. He should like Mr. Butterfield to express an opinion as to the points he had mentioned as to minimizing the danger by making the men understand that the tar had to be driven into the heart of the road, and not left upon it in a film $\frac{1}{8}$ inch to $\frac{1}{9}$ inch thick, because it seemed to him that, if the tar was to do any good and waterproof the road, the waterproofing had to be done down below. In this way, they not only effected a more substantial water-proofing, but they keyed together the granite; and it was then far more capable of doing its work longer, and was more satisfactory all round than if they simply smeared the surface over, and did not make any effort to secure deep penetration. They found they had a penetration of 2 to 3 inches. This was all done by hand, with, of course, portable boilers. The tar was brushed in by three pairs of men. The first two had bass brooms; the second pair, heavier bass brooms; and the third pair were young men who had to brush as strongly as they could. His instructions were to leave nothing on the surface, but to get it down below. The dimensions of the filters he used were 6 ft. by 5 ft. by 3 ft. 6 in.

Mr. W. Harpur (Cardiff) acknowledged the value of the paper, upon the merits of which, however, he had no intention of speaking. It hardly applied to a town like his. They used nothing but distilled tar; and there was nothing in the way of tar off his roads that could get into any stream where there were any fish. The washings found their way into the sewers, and ultimately into the Bristol Channel. Therefore, there was no risk whatever in his case, as to injury to fish life from the use of tarred surfaces. He thought the paper practically confined itself to the use of tar upon country roads, where the water from the surfaces got directly into the streams, and was not treated in any way on sewage-purification works.

Colonel R. E. Crompton, C.B. (Consulting Engineer to the Road Board), said, in common with a great many others in the room, he had sat at the feet of Mr. Butterfield. He had consulted him for a long time past; and he should be greatly surprised if he said anything in a paper of this kind which would fail to be of extreme use to all of them. He (Colonel Crompton) was in the position of suffering from the fish scare perhaps more than any man in the country. It almost meant an extra clerk in his office to attend to correspondence calling upon him to say something authoritative to contradict the scare which fishermen had got, that tarred roads were going to destroy fisheries all over the country. He really thought the number of fish that had actually been killed was so small that he doubted whether they had been killed by tar at all. Really, the evidence that there had been any change in the number of dead fish found was so extremely small or slight that, as he said, it was not going too far to say it was very exceptional that fish had ever been killed by tar. This was the evidence to his mind; the keen fisherman thought otherwise. Mr. Thomas had put the case very fairly. There should not be any possibility of any quantity of tar water, or ammoniacal liquor, being washed off the road. Mr. Thomas had adopted all various devices for intercepting the ammoniacal liquor on its way to the watercourses, with the success that he pointed out. He had had no complaints, though he had had skilled experts watching him to see that he took proper precautions to protect their fisheries. He (Colonel Crompton) thought this was a proof that this was a scare, and that the risks were small. He had always used the argument that if all these tars were pernicious to fish life, why was it that, when boating on the Thames, they saw everything tarred everywhere. This did not kill fish. When he first read the paragraph of the paper commencing, "In the third series, the first experiment was made with tar C, which was painted on the whole of the inside of the vessel," he found it did not give very good results, but later on it did do so. He submitted this to Mr. Butterfield, that they could not handle fish, and take them in and out of tanks, without making them a little bit sick—more especially gudgeon and dace; if Mr. Butterfield had used eels, he might not have had the same result. [Laughter.] With tar C, a certain number of fish died. But trout required a highly aërated water. The death of the fish might have been due to the fact that they were sick before they were put into the vessel; or it might have been due to the want of aëration.

Mr. A. Gladwell (Eton Rural) agreed that a considerable amount of valuable information would be gathered from the paper. He had noticed Mr. Thomas's system of working on tarred surfaces; and he had also observed, with some surprise, the results he obtained from well brushing the tar into the road structure, and allowing it to soak into the roads, instead of putting on other surfacing in the way of chippings or otherwise. With the exceptions of extreme variation of the weather, the work certainly did stand very well indeed—much better than he anticipated it would. So far as he was himself concerned, he leaned rather to the theory and practice of the incorporation of the tar in the road at the time of reconstructing the surfaces. He believed there was a large quantity of tar put on the surfaces of roads which could be much better used if incorporated in the structure, because, after all was said and done, he believed the penetration of the tar was not so great as was sometimes imagined. He did not see how it could be, because it was a question, more or less, of capilliary attraction. He thought the intention of the paper was rather to reassure those who were at all nervous as to the inimical results of the use of tar upon fish. Tar had to be put on the roads; and the only thing they could do was to eliminate as far as possible the liability of any polluted water from tar washings getting into streams.

Mr. Walter V. Anderson (Winchester) was understood to say that he was not comfortable in regard to the use of either crude or freed tar. He asked Mr. Thomas whether the small filters of which he spoke were in urban districts or only on the roadsides of country areas. He (Mr. Anderson) had a system in which there were 18-inch pipes, which were sometimes running full bore; and nothing but large filters would be of use under such circumstances.

Mr. H. Percy Boulnois (a member of the Advisory Engineering Committee of the Road Board) said he was not a chemist or a gas engineer; and to properly discuss the paper one would have to have some intimate knowledge of tar and its compounds. In the paper, Mr. Butterfield spoke of chemical compounds of which he (Mr. Boulnois) had never heard. He saw such things as toluidine. Of course, pyridine one could understand a little better. But all through the paper words were used which were enough in themselves to kill fish. The experiments set forth as to the effect on fish life of water which had been in contact with coal tar were clearly within the range of practical politics. Almost any surveyor could carry out these experiments without all the beautiful paraphernalia of which Mr. Butterfield could boast. The results were set forth in a table the headings of which showed the volumes of water agitated with one volume of tar, and the

temperature of the water during extraction (which was practically all through nearly alike); then there were the minutes that elapsed before the fish died. Now, one thing that struck him about this table was that it took 1 volume of crude light tar to 200 volumes of water to kill fish in fifteen minutes, while it took, with 1 volume of crude heavy tar mixed with 200 volumes of water 80 minutes to kill fish. Now the chances of life of fish that had been taken out of their native element, and put into a tank, were much diminished. But apart from this, he thought it would be gross carelessness on the part of any surveyor to allow 1 volume of tar to escape with 200 volumes of water. He must either leave his gulleys unprotected, or there must be some other means by which tar got into the streams in such volume. Fish, too, he believed went in shoals; and they frequented certain parts of streams and rivers where they could best get food. One question he should like to ask Mr. Butterfield was whether a tar that complied with the specification of the Road Board would be dangerous to fish; and, if so, to what extent.

Mr. T. Milne (Gaslight and Coke Company) said he should like to join in the thanks to Mr. Butterfield for his paper. He must confess he was present as one who was interested in tar and ammonia; and when he first looked through the paper, he was a good deal discouraged. But he saw later that it was stated that the conditions under which these experiments were carried out were more or less unnatural or artificial. He could hardly suppose that fish in their native element, if they found themselves in uncomfortable surroundings, would not get into others less uncomfortable. Under Mr. Butterfield's kind attentions, however, they could not alter their surroundings if they wished to. In his opinion, if road surveyors would use water-freed tar, and of a gravity of not less than 1·2, they would have no trouble whatever. He thought Mr. Butterfield showed where the chief trouble arose; it came from the ammoniacal liquor in crude tar. If they freed the tar from water, they took out the ammoniacal liquor; and they also, at the same time, removed the light oil, which created the film of which Mr. Butterfield spoke with considerable severity. He said the film was even worse than ammonia. There was one other point of which Mr. Butterfield spoke, and that had connection with sulphate of ammonia, which was one of the most efficient of fertilizers. If they got it into water, there was no doubt it would injure fish. But when they put it into the land it became fixed, so that they could not get it into the water. Owing to certain chemical reactions which immediately began to take place in the soil, sulphate of ammonia could not be washed out in the same way as nitrate of soda and other forms of nitrates.

Mr. A. Dryland (Surrey County Surveyor), with a very large practical experience of the use of tar on roads, agreed with Colonel Crompton, that the fear expressed with regard to fish life had little justification, provided reasonable precautions were taken; and more particularly did he think precautions needed to be taken in towns and places where there was a surface-water drainage system going direct into streams. The water from many of the country roads in the summer time never reached the streams at all. On the chalk hills, for instance, it was absorbed into the soil; and in these cases there need be no fear of fish life, whether crude or freed tar was used. Personally he knew that tar would kill fish. He had known instances in which it had done so; but they had been extremely exceptional cases, and never ought to have occurred at all. In his own experience, with tar-surfacing extending over five or six years, in large areas, he had never yet had instances of fish being killed, except in two cases under extraordinary circumstances. One was a case in which crude tar was used in enormous quantities, so much so that it ran down the channels; a heavy thunderstorm came on, and washed the tar into a stream. Another case was where some tar macadam was laid in winter time. It was prepared to be laid, was spread on the road, and left unrolled for some days in close proximity to a fish-pond. The washings from this tar macadam flowed into the pond. In, however, the general sense of washings from tarred roads going into streams, he had had no complaints, nor had he any information of any instances of fish being phenolicly killed or injured. There was very little crude tar used now for roads; and surveyors all tried to use freed tar. At the same time, there were cases where there was no danger where crude tar could be employed. Though the experiments before them were extremely interesting, they did not reproduce quite the same conditions as occurred in streams. He thought it was quite understandable that, with tar in a vessel in which dangerous products had been mixed for a long period, and fish exposed to them, the fish would die; but he did not think that these conditions would obtain in a running stream. If fish did not like their surroundings, they would get away from the tarry matter altogether. The paper, however, showed them they must use care where there was danger of tar getting into streams. This was the thing to keep in mind; and they must, and did, take precautions, so that no evil effects occurred. There was not the slightest need for it, and he thought there was not the least danger to the fish life of the country.

Mr. F. J. Wood (East Sussex County Council) remarked that the matter affected him very little, inasmuch as he had made a practice of using nothing but heavy distilled tar for the surfaces of his roads. He had not used a tar of less specific gravity than 42° Twaddel—that was, about 1·21; and in no case had it contained any water or gas liquor, or ammonia compounds. In his part of the county, they had very few rivers; but it was a most important thing in counties where there were rivers that the material used in the treatment of the surfaces of the roads should, as far as possible, be free from the constituents which might be harmful to fish life. In Table IV. he saw that D freed heavy tar was used in the proportion of 1 volume to 200 volumes of water. Did this tar contain any phenolic bodies? If so, in Table II., where they had phenols, 0·1 part in 1000 parts of water, gudgeon died in 60 minutes; whereas in Table IV. the gudgeon with the heavy freed tar died in 135 minutes.

Mr. Thomas, replying to the question put to him, said the filters he referred to were only small ones in small drains in country roads. But with 18-inch pipes, if there was enough tar to kill fish something ought to be done to stop it.

Mr. Butterfield, in reply, thanked those present for their kind remarks, and for the appreciative way in which they had received the paper. He fully admitted that parts of it, as one speaker suggested, were academic; but he thought that, from time to time, cases would arise which would show that even the academic portions of the paper had some real practical application. It might not at the moment be obvious what the practical application might be; but the scheme of investigation was carried out consistently with the view of demonstrating what ingredients of road-treating materials were, in extreme conditions, likely to be harmful to fish, and what ingredients were innocuous. Especially, the investigations showed the worst results obtainable with the fish with the particular ingredients stated. In all practical conditions, these results would be modified, in that the fish would not be so liable to premature death. There were several reasons why these modifications would occur; and to some of of them speakers had alluded. One was that very seldom did road washings reach streams without some sort of filtration and purification by passage through air, over sand, or in contact with vegetable or other organic matter, any one of which conditions was destructive of the harmful ingredients in the tar. Here the harmful ingredients had been tried under conditions in which their effect was not minimized in any way. In the practical use of road-treating materials on the road, the conditions would certainly minimize the effects, as compared with those shown in the paper. In regard to Mr. Thomas's remarks, he observed that fish varied in temperament. This he (Mr. Butterfield) early in the experiments realized; and so where inconclusive results were obtained, experiments were repeated. He thought the results of the experiments might therefore be regarded as a fair average. As to the question of the effect of keeping fish in unnatural conditions, handling them, and putting them into these solutions, there again he realized that the resistance of the fish in natural conditions would be greater, and might add something on to the time which would elapse before death in all cases of the kind. But the results as between one material and another were comparable; and in this he thought they had some definite information. Concerning the question of the cost to road authorities, if it had been in all cases safe to use crude tar on the roads, he supposed it would never have occurred to him to make these experiments. But Colonel Crompton and others had testified that there was a very wide outcry against the use of tar at all in some places—there was a great amount of prejudice existent; and he (Mr. Butterfield) wanted to ascertain what real basis it had. He believed he knew more now than when he started the work; and he had come to the conclusion that tar, if reasonably free from ammonia and light oils (as tar that complied with the Road Board's specification was) was, in all ordinary conditions, absolutely safe. Occasionally, a surveyor was perhaps harassed by complaints from local anglers or owners of fishery rights; and he was asked by his Council to put down material which it was absolutely certain would do no harm to the fishery streams. It might be the washings from roads passed, with very little dilution, or very little filtration, or preliminary exposure to the possibilities of oxidation, into the fishing water. In that case, the surveyor asked for something which would safeguard him still more; and he (Mr. Butterfield) had indicated what he thought would safeguard him absolutely, even under extreme conditions. Filtration, as Mr. Thomas had suggested, undoubtedly reduced to very little the risk of pollution of streams from the use of crude tar, as did also the obtaining of considerable penetration of the surface of the road. He tried to emphasize in the paper that it was the surface exposed to the action of the water that mattered, and not the quantity of the tarry material put on the road. It was a question of the proportion of water falling on the surface of tar, and the impingement of the water on the tar—*i.e.*, the extent to which it was mixed. In these experiments where tar was agitated with water, they had the extreme conditions which would never be realized in practice. There was vigorous agitation of the tar with the water for fifteen minutes; and the extraction that occurred in such case of phenolic and other constituents could not possibly happen in any natural conditions. He was very much indebted to Colonel Crompton for his remarks; and he thought what he had said as to the way complaints (whether justified or not) had rolled in was sufficient reason for dealing with the matter in the paper. He (Mr. Butterfield) agreed that, if reasonable precautions were taken in the tarring of roads, no deaths of fish due thereto were likely to arise. The fish might die for quite other reasons. Respecting the possible sickness of the fish used in the experiments from handling or being kept in unnatural conditions, he might say he found no difficulty in keeping trout apparently quite healthy for months at a time, provided the water was well aërated. He tried to imitate these conditions in making the experiments with trout. He was sorry to hear that Mr. Anderson was not comfortable in

regard to the use of tar; and he would suggest, with great diffidence, knowing the conditions under which Mr. Anderson was working, that he really should ascertain whether there were not other circumstances which might have been responsible for any loss of fish in the neighbourhood of his tarred roads. He (Mr. Butterfield) knew something of the character of the tar put down in his neighbourhood; and it was almost inconceivable that any harm resulted therefrom. The County Surveyor of Hampshire (Mr. Taylor) had spoken to him the previous day, and told him that he regretted he would be unable to be present at the meeting, but that he (Mr. Butterfield) might state from him that 100 miles of road in his county were tarred last summer, and he knew of no authentic case of fish being killed by the use of the tar. The fishing rights in Hampshire were probably more valuable than in any other county. This was testimony which was only controverted by some unfortunate accident of which Mr. Anderson had had experience. The tar used in Hampshire last summer substantially ranged in composition between tars C and D. Some of it was more nearly like tar C, and some more nearly like tar D. It was a freed tar. Mr. Boulnois need not be frightened of the "terrible" words describing the ingredients that were present in tar. These were definite bases; whereas other ingredients were acids. And it was important to know whether they were the basic bodies or the acid bodies which were most harmful to fish. Ammonia—a basic body—had proved very harmful indeed. Mr. Milne's remarks he had already incidentally dealt with. The conditions given were immaterial; and the effects would be minimized in practice. But in regard to the effect of sulphate of ammonia, applied to the soil as a manure, it would naturally not be, under ordinary circumstances, washed into the streams. It would be converted into nitrates by the organisms in the soil; and the effect of these organisms had to be taken into account also in considering the possible effect of the ammoniacal liquor in crude tar on streams. If it were not that the washings might go direct into streams without passing through sand or soil, they need not fear to use crude tar at all, just as they need not fear to apply sulphate of ammonia to the land. But unless one could be sure of giving the nitrifying organisms a chance, without doubt the ammonia salts were very deadly. Mr. Dryland's remarks bore out that there was a greater risk in the use of crude tar than in the use of freed tar. The case where the tar macadam was left unrolled, and the washings passed into the fish pond illustrated one thing that he (Mr. Butterfield) was trying to say in the paper—that it was the surface exposed that mattered. In an unrolled metalled road, they had the largest exposure of surface to the washings they could possibly have. Then, again, in the instance cited, the washings passed into a pond, and not into a running stream, and concentration might go on in the pond when the dry weather came. Those were the conditions that were the most likely of all to be harmful to fish. As to Mr. Wood's question regarding the estimation of the phenolic bodies in the extract of tar D with 200 volumes of water [see Table IV.], the amount was so small that it could not be estimated with certainty; and he did not mind saying the phenolic constituents of the extract were the only poisonous constituents there were. But they were the ones most easy to detect. The proportions of phenol referred to in Table II. were obtained by the direct weighing of the phenol which was put into the water, and checked by estimation. It was easy to estimate the phenol in clean water; but when one had an extract containing all sorts of ingredients, he knew of no exact way to estimate small quantities of it.

Mr. Thomas asked Mr. Butterfield what he thought as to the probable result of the enormous quantity of lubricating oil scattered over the roads by motor traffic in respect of the question of water pollution. They had a large mileage of roadway now tarred; and anything in the shape of oil gravitated to the gutter and into the ponds and streams. Would this to any extent accentuate or tend to fish poisoning? It struck him that being oil they would get a very thick film on the surface of the water, and this must largely affect fish life beneath it. The aëration of the water was lost tremendously; and it was this which exposed the fish to any disease that might be about.

Mr. Butterfield answered that he had dealt with the point to some extent in the paper when he showed the effect of films of motor lubricating oil, and gasoline or petrol. The effects were less marked than with similar grades of oils derived from tar; but the film from such materials would undoubtedly kill in time. The water-proofing of the roads by tar or asphalte, rendered such materials more liable to be washed into streams than when they fell on to a water-bound and porous road.

The Yorkshire Junior Gas Association will meet next Saturday afternoon, at the Leeds Institute, Cookridge Street, when papers will be read on "Supplying Outlying Districts with Gas at High Pressure," by Mr. J. Kennington, of Grimsby, and on "Coal Testing," by Mr. C. Ostler, of Halifax.

Society of Engineers.—The first ordinary meeting of the session was held on Monday last week, when the retiring President, Mr. F. G. Bloyd, presented the premiums for papers published in the Society's "Journal" during the year 1911. The President's Gold Medal was awarded to Mr. W. R. Baldwin-Wiseman, for his paper on "The Administrative Aspect of Water Conservancy," which was noticed in our columns at the time it was read. At the close of the presentations, the new President (Mr. John Kennedy) delivered his Inaugural Address, and a cordial vote of thanks was accorded to him.

FREE GAS APPLIANCES.

[Communicated.]

The recent decision of the Glasgow Corporation to supply domestic gas appliances free of rental arouses anew an interest in the vexed question how best to increase the consumption of gas for daylight and summer uses. That some inducement is necessary is admitted by many administrators of gas undertakings. In the first place, gas has, when used for these purposes, very severe competition to meet in the form of solid fuel—competition so severe that the price should, and can be, reduced to a substantial extent. Secondly, it may be quite easily proved that gas sold for such uses shows a relatively larger profit than that sold solely for lighting and winter consumption.

It cannot be gainsaid that immense progress has been made in the supply of domestic appliances using gas during the summer months and in daylight hours. In the large majority of cases, this has been effected without any inducement in the form of discounts or free rental. In many districts, however, there is a feeling that the adoption of such appliances is nearing the saturation point, which means that all those consumers who fully realize the advantages of such apparatus have already been supplied. To persuade the remaining consumers to use gas for cooking and heating purposes, some increased inducement must be offered to draw them into the net. It will thus not do for gas undertakings to remain stationary. When it is realized that the limit of expansion has been reached, a strong case can be made out for the adoption of some such step as the Glasgow Corporation have taken, and as Mr. W. R. Herring advises in his recent report to the Edinburgh and Leith Gas Commissioners.

Mr. Herring shows that, in the case of the Edinburgh gas undertaking, the saturation point is approaching; and he accordingly recommends the supply of domestic and industrial appliances at a small, almost nominal, rental of 5 per cent. on the cost, including fixing. In advising such a step, he expresses the opinion that "there is a great possibility of increasing the use of gas for domestic and industrial purposes if some means can be devised whereby the consumer can become possessed of the necessary appliances for its economical use without bearing the first cost of its installation." He then proceeds to show how much more profitable it is to induce present consumers to increase their consumption of gas in preference to adding to the number of consumers. This point deserves to be strongly emphasized; for, generally speaking, much more energy is devoted to gaining new consumers than there is to persuading existing consumers to increase their consumption. The present charge for gas in Edinburgh is 2s. 8d. per 1000 cubic feet, as compared with which Mr. Herring shows that an additional quantity up to a substantial amount could be supplied to the present consumers at a cost of 1s. 1d. per 1000 cubic feet. Similar reasoning could be applied with equal force to scores of other undertakings. The policy advocated is an attractive one, not to those undertakings which are netting 5 to 10 per cent. increases in gas sales year by year, but to those which have reached a stage when 1 or 2 per cent. increases are the most which can be expected.

In an article, "Differential Prices for Gas," in the "Journal" for Dec. 29, 1908, the writer strongly advocated a policy of supplying domestic appliances free of rental by gas undertakings with which the continued expansion in sales was improbable. In that article, an instance was given of a consumer who used 43,000 cubic feet of gas per annum for lighting alone, but who increased his consumption to 115,000 cubic feet on being supplied with a cooking stove, a geyser, and three gas-fires. This is a typical instance of what might be expected as a result of supplying approved consumers with such appliances. In the case mentioned, the outlay to get the consumer was £11 13s. 8d., including fixing. This is a large sum to spend on one consumer, and is indeed about equivalent to the amount expended on three slot-meter installations. But, on the other hand, the return on the above-mentioned basis is far more profitable, for a prepayment consumer uses not more than an average of 10,000 cubic feet per annum. It is now universally considered a sound business proposition to invest £4 in a workman's dwelling to obtain increased consumption. Why should it not be an equally good investment to spend £8 in a better-class house with the object of increasing the gas used in the summer and in daylight hours throughout the year? The money need not be spent except in approved houses where the return is likely to be profitable, and the appliances could be removed at the option of the company or corporation.

Such an investment could not on any account be considered as sound unless it is first proved that additional sales of gas carry a large margin of profit, as it is shown by Mr. Herring in his report would be the case at Edinburgh. Here it is seen that the standing and distribution charges amount to more than double the works' costs; and it is the latter only which recur—at least, to any extent—in the case of the additional gas sold to existing consumers. By such reasoning Mr. Herring makes the position clear to any business man, who will at once see that it calls for the same treatment as has met with such phenomenal success in the case of the slot-meter installations. Progressive men will receive the report with much pleasure, and will confidently predict that the adoption of the policy of free gas appliances will give a substantial fillip to the development of gas consumption for domestic purposes.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

Visit to the Kensal Green Gas-Works.

On Saturday afternoon, the members of the London and Southern District Junior Gas Association paid their second visit to the Kensal Green works of the Gaslight and Coke Company. The members, to the number of about seventy, were received by Mr. C. A. Cunnold, the Engineer of the works, and the Assistant Engineers (Mr. J. H. Methven, Mr. F. P. Marshall, and Mr. E. G. Stewart). The party then divided up into detachments, and were conducted over the works by the three last-named gentlemen. They lingered for a considerable time in the vertical-retort house, where Mr. J. Leslie Cloudsley, representing the Woodall-Duckham Vertical Retort and Oven Construction Company, Limited, after presenting each visitor with "A Short History of Carbonization in Vertical Retorts," gave a description, and pointed out the working, of the plant.

The first inspection took place about three years ago; and in connection with that visit, a description of the works appeared in the "JOURNAL" for Jan. 19, 1909 (p. 167), to which readers may be referred. At that time, foundations were being put down in the old retort-house for an installation of Woodall-Duckham vertical retorts. The plant was completed during that year; and it constituted one of the principal attractions to the visitors on Saturday. The installation consists of nine settings of four retorts to a set; each retort being 23 ft. 6 in. long, and 29 in. by 21 in. at the bottom, tapering to 21 in. by 9 in. at the top. There is also one setting of two rectangular slot retorts, each 25 feet long, and 5 ft. 6 in. by 1 ft. 6 in. at the bottom, tapering to 4 ft. 6 in. by 9 in. at the top. The plant was installed to produce 1¼ million cubic feet of gas per day; and the ground space occupied is about half of what would be necessary with horizontal retorts. The power required for working the installation is supplied by two electric generators of 63 H.P. and 20 H.P. respectively; the larger generator being used only when the coal is being broken and elevated to the overhead hoppers. On being received into the house, the coal is passed through a breaker, and elevated on to two push-plate conveyors running over the two sections, delivering coal into storage-hoppers fixed immediately over the charging-drums of the retorts. The coal is fed automatically and continuously into the retorts through feed-roll drums kept continually revolving at any determined speed by rocking shaft and ratchet apparatus. The retorts are worked at a high temperature at the top end; gradually lessening towards the lower portion, until at the discharging end a dull heat is reached. Here the coke passes into the discharging-drums, and is quenched and emitted at every revolution of the drums on to the coke-floor placed beneath the settings. These discharging-drums can, like the feed-roll drums, be worked at any required speed. Fitted between the sections is an electric lift, for raising coke from the ground floor to the producers. The make of gas with Blackwell (Derbyshire) coal is from 11,800 to 12,000 cubic feet per ton; giving a gas of 15-candle power, which can be varied by the rate of travel and alteration of temperature. The coke is so large and dry from this setting that the local dealers can make 1s. per ton more on it in the neighbourhood for domestic fuel—there being quite a keen competition among the hawkers and small buyers for the coke from the vertical plant.

The total manufacturing capacity of the works is 15 million cubic feet per day; and, in addition to the vertical retorts already mentioned, the carbonizing plant includes, in another retort-house (No. 2) 36 settings of inclined retorts set at an angle of 31°. The retorts are ⏢ shape, 24 in. by 14 in., eight to a bed. They are charged with 8½ cwt. to 9 cwt. of coal three times in 24 hours. The coal is deposited in the main coal-breaker from barges in the dock by grabs, elevated to the main push-plate conveyor running over the settings, and conveyed into overhead storage-hoppers and charging-shoots fixed the whole length of the house. Coal-stores of 5000 tons capacity range each side of the settings. They are fitted up with push-plate conveyors for loading the stores, and continuous conveyors for emptying the coal out of the bunkers and carrying it to elevators fitted on each side of the house for depositing it on to the main conveyor running over the sets. The hot coke from the retorts is directed on to De Brouwer conveyors fitted at the stage level, which remove it to the centre of the house, where it is quenched and conveyed outside to a series of hoppers capable of holding some 250 tons. Here the trade are supplied direct from the hoppers to carts, trucks, and other conveyances. Power for this house is supplied by Galloway compound steam-engines of 120 H.P., in duplicate, and by two gas-engines of 40 H.P.

Another interesting feature of the works is the carburetted water-gas plant, which consists of six sets, each able to make 1¼ million cubic feet a day. The coke for the generators is loaded direct from the retort-house storage-hoppers into trucks, and drawn to the plant by small locomotives. The trucks are raised above the charging-floor by a hydraulic lift, and the coke is tipped on to a De Brouwer conveyor travelling from end to end of the house, filling the charging-hoppers, which are fixed directly over the generators—an adjustable charging-shoot joining the two. It may be pointed out that the whole installation, including the unique labour-saving arrangements for the coke supply, was constructed to the Gaslight and Coke Company's own designs. In connection with the plant, there are four Babcock and Wilcox boilers; Westinghouse engines of 40 H.P. being employed in driving the Sturtevant blowers for the air-blast. The oil storage is of a maximum capacity of 2 million gallons.

Among the other interesting items inspected was the arrangement for dehydrating water-gas tar. By means of exhaust steam, the oil-gas tar containing up to 50 per cent. of water is heated to 180° Fahr.; and is then pumped into a settling tank, where, on cooling, the tar separates and the water is run away. The tar is then pumped into a store-tank, and eventually sent away in barges. Last year, 150,000 gallons were sold—a record for this station. Then there were the booster for sending gas on the district in times of sudden calls and heavy consumption; and the "Hastings" plant, which, by spraying 3 gallons of paraffin per million cubic feet of gas, reduces the naphthalene to 1½ grains per 100 cubic feet on the outlet. Attention was also called to the ambulance station on the works, and the very up-to-date laboratory.

After the inspection, the visitors were invited to tea in the large recreation-room; and at the conclusion of this, the President (Mr. J. G. Clark) said all present would agree as to their indebtedness to the Gaslight and Coke Company for making the Association a success from an educational point of view, by allowing them to visit the works and see the advances that were being made in the methods of carbonization. Mr. D. J. Winslow (Senior Vice-President) proposed a very hearty vote of thanks to the Directors and officers of the Company for their kindness in allowing them to visit the works for the purpose of inspecting the vertical retorts, as well as for their hospitality. They were, he said, also indebted to the gentlemen connected with the works who had given up their afternoon for the benefit of the members. Mr. J. Hewett seconded the vote, Mr. H. M. Tysoe supported, and it was heartily carried. Mr. J. H. Methven, in responding, said they were glad to see the members there that afternoon. It gave the Company a great deal of pleasure to throw open the works to them, so as to enable the members to see the Woodall-Duckham plant. He drew attention to the result of a test that had been made on this particular setting with Aldwarke Main washed nuts, as follows:—

THE GASLIGHT AND COKE COMPANY,
KENSAL GREEN.
WOODALL-DUCKHAM SYSTEM OF CONTINUOUS CARBONIZATION.
Test made Aug. 12 to 18, 1910, with Aldwarke Main Washed Nuts.

Total coal used	315 tons.
Total gas made	4,154,000 cubic feet.
Gas made per ton	13,187 cubic feet.
Candle power	15·35 English candles.
Calorific value	136·0 calories gross.
Dry coke and breeze sold per ton of coal carbonized	11·38 cwt. = 56·9 per cent.

MIDLAND JUNIORS AT SMETHWICK.

Favoured by perfect weather, members of the Midland Junior Gas Association, to the number of about a hundred, paid a visit on Saturday afternoon to Smethwick, to carry out an excellent programme which had thoughtfully been arranged for them. Assembling at the gas offices in Rabone Lane, they were met by Mr. Vincent Hughes (Gas Engineer), Mr. C. W. Pinkney (Chairman of the Gas Committee), Mr. A. M'D. Duckham (of the Woodall-Duckham Vertical Retort and Oven Construction Company, Limited), and Messrs. Vale (of Messrs. Thomas Vale and Sons, Limited). After the party had been divided into four groups, an inspection of the gas-works was made—under the guidance of Mr. Hughes, Mr. Douglas Cooke, and other members of the staff. The members were first of all presented with a copy of "A Short History of Carbonization in Vertical Retorts."

Smethwick, it may be recalled, originally formed part of the district supplied by the Birmingham and Staffordshire Gaslight Company, which covered an exceedingly large area. The Company's powers were in 1875 purchased by the Birmingham Corporation—a clause being inserted in the Bill to enable the outlying districts, subject to arbitration, to erect works for themselves. This was a privilege of which (after lengthy legal proceedings) Smethwick, along with West Bromwich, Oldbury, and Tipton, subsequently availed themselves. In October, 1881, the Smethwick works—which adjoin the London and North-Western and Great Western Railways—were opened; and since that time there has been great progress in the output of gas. In the year following the opening, the quantity of gas sent out was 123½ million cubic feet; while for 1911 the output was just over 483 million feet. Mr. Hughes succeeded Mr. B. W. Smith as Engineer in the year 1900; and Mr. W. J. Sturges has occupied the position of Secretary to the Gas Committee from the time when the works were opened.

Just now the capacity of the works is much below the requirements; and consequently extensions are being carried out. The members were able to inspect two sets of twin exhausters which have lately been installed by Messrs. George Waller and Son; the capacity of each of the four being 60,000 cubic feet per hour. These are so arranged that any one or more exhausters may be used. Then there are in course of erection new water-cooled condensers, consisting of four units, each of a capacity of one million cubic feet per day, as well as scrubbers and washers of similar capacity. But, without disrespect to the other portions of the plant, it may be said that the chief feature of interest to the

visitors was the new installation of vertical retorts on the Woodall-Duckham system, which they were able to see at work. This has been put up in No. 1 retort-house, in which there are also a number of horizontal retorts in operation. There are six beds of verticals, each containing four retorts. The retorts are 25 ft. long and 5 ft. 3 in. by 19 in. at the bottom, tapering to 4 ft. 3 in. by 8 in. at the top. As each retort will carbonize about 4½ to 5 tons of coal per day, there is a total capacity of from 108 to 120 tons per day for the six beds. The coal is elevated by a gravity bucket conveyor from hoppers at the railway siding to storage hoppers over the retorts; and similar conveyors are provided for elevating the coke for feeding the generators, &c. The whole of the coke from these retorts will also be removed by conveyors. A portion of the coal-stores adjoining the retort-house has been transformed into a power-house, in which there is one small gas-engine for working the coke-extractors, while two others generate electric power for operating the conveyors.

In addition to the vertical and horizontal retorts, there is also a house devoted to four arches of inclined retorts. In the ordinary course of things, practically the whole of the coke from the inclined and horizontal retorts is removed by conveyors to an elevator that raises it to an overhead conveyor, from which it can be dropped into barges (a branch of the Birmingham Canal runs into the works), shot into the yard, or taken along to a bucket conveyor and elevator for the water-gas house. In the latter house there are two complete sets of carburetted water-gas plant by the Economical Gas Apparatus Construction Company; the total capacity being equal to a million cubic feet per day. The coke is taken by the elevator to the top of the house and tipped into the hoppers. Along with this complete coke-handling plant, comprehensive arrangements have been made for dealing with the coal. Until 1906, the whole of the coal was carted into the works. Though for years various schemes for constructing a siding had been proposed, the impossibility of obtaining land, and other difficulties, had prevented the carrying out of these ideas. Eventually, however, these troubles were all surmounted; and the Gas Committee decided upon an elevated siding of sufficient strength to carry waggons of 50 tons capacity. The scheme which was carried out on these lines necessitated a bridge over the canal, of nearly 150 feet span and 15 feet wide. The Corporation have a locomotive of their own on the sidings; and it is proposed shortly to purchase some large hopper-waggons for the coal traffic. The double-platform weighing-machine on the sidings will carry 100 tons and weigh up to 80 tons. The coal drops from the waggons into the yard or into a hopper from which it is fed to the retorts. The purifying plant consists of four oxide and three lime boxes for the coal gas, and four boxes for the water gas. The Braddock station meter is capable of passing 125,000 cubic feet per hour; and the capacity of the gasholders is nearly 1,400,000 cubic feet —which, however, it is pointed out, is very inadequate, inasmuch as the daily output of gas in winter sometimes exceeds 2,250,000 feet. Water is raised by compressed air to an overhead tank from an artesian well; the capacity of the plant being equal to 10,000 gallons an hour. Readers may be reminded that two illustrations of the works appeared in the "JOURNAL" at the time of the visit to Smethwick during Mr. Hughes's presidency of the Midland Association of Gas Managers.*

Leaving the gas-works, where they had just seen the latest system of gas manufacture in operation, advantage was taken by the party of the permission of Messrs. W. & T. Avery, Limited, to inspect the old gasholder on their ground erected by Murdoch. An illustration of this holder appeared in the "JOURNAL" for Aug. 24, 1909 (p. 507). Having thus had their thoughts removed from the present time to earliest days of gas lighting, members for some while had them kept there. Leaving the old gasholder, they crossed from the gas-works to the opposite side of the road, where the works of Messrs. Tangyes, Limited, are situated. Here they were accorded the privilege of examining, and having explained to them, the contents of the Watt Museum, owned by Mr. George Tangye. The party were met by Mr. R. H. Kirton (who has the museum, so to speak, under his wing) and Mr. A. G. Stanners; and under the able guidance of the former gentleman, it is safe to say they got as good an idea of what the museum holds as was possible in the time at disposal. The subject upon which he discoursed was, it could be plainly seen, as dear to the heart of Mr. Kirton as it was interesting to his hearers. There is gathered together here a valuable collection of relics—consisting of manuscripts, drawings, models, &c., of Murdoch, Boulton, and Watt—which has, it may be stated, been given to the City of Birmingham, and is now only awaiting the completion of its new home for its removal from Messrs. Tangyes' works. Exigencies of space render it impossible to give anything like an account of the historic articles which are to be found surrounding busts of Murdoch, Boulton, Watt, George Stephenson, Robert Stephenson, John Penn, and Sir William Fairburn; but it may be said that these include models of Murdoch's steam-engine and his rotary pump. There is correspondence, too, which throws a clear light upon the nature of the treatment which Murdoch received in connection with the steam-engine that he invented. Before leaving the museum, a hearty vote of thanks was accorded to Mr. George Tangye and Mr. Kirton, on the proposition of Mr. R. S. Ramsden; and Mr. Kirton, in response, said that, as long as the relics remained where they now were, he would always be pleased to show any of the members round the museum.

* See "JOURNAL" for June 7, 1910, pp. 623-4.

A return was then made to the gas-works, where, in the meter-house, the visitors partook of tea, at the invitation of the Woodall-Duckham Company. Mr. W. H. Johns said that, in the absence through indisposition of the President (Mr. R. J. Rogers), he had pleasure in proposing a vote of thanks to the Chairman and members of the Gas Committee for their kindness in allowing the Association to inspect the gas-works, with its up-to-date carbonizing installation; to Mr. Vincent Hughes, for his courtesy in showing them round, and, with the members of his staff, explaining the whole of the details connected with the plant: and to the Woodall-Duckham Company for their entertainment. He felt sure that the members would leave the Smethwick Gas-Works with more knowledge than they possessed at the beginning of the inspection. Mr. A. O. Jones, in seconding, remarked that they had spent a very instructive afternoon. The vote was carried with applause; and Mr. Duckham, in acknowledging it, said it was difficult to explain everything to so large a party; and he would have liked to have taken members round individually. His Company were at all times only too glad to give all possible information; and he hoped on some future occasion to see members of the Association there or at some other installation of Woodall-Duckham vertical retorts. Mr. Hughes also returned thanks, and expressed his great pleasure at seeing so large a gathering. He assured the members that if any of them would like to look at the verticals at any time, he would be extremely pleased to show them. With a big party, it was very difficult to give anybody a really clear answer to points that might be raised. It was, he thought, rather unique that they should come to Smethwick to see an installation of vertical retorts —the most up-to-date thing in carbonizing—and then, within a few yards, should be able to make an inspection of so many relics of Murdoch. Mr. Kirton had made the visit to the museum very interesting indeed.

Publication by the American Gas Institute.

Under the title of "Gas Institute News," the Directors of the American Gas Institute have commenced the publication of a "Bulletin" which will acquaint the members with the general affairs of the Institute, and embody any specific information which may be of interest—for example, announcements by the President, Secretary, Directors, Chairmen of Committees, &c.; elections, resignations, &c.; "question-box" and "wrinkles;" preliminary reports of Committees, with suggestions; and correspondence regarding the work of the Institute. The first number, consisting of 16 pages in a wrapper, is dated the present month; and its successors will appear at intervals during the year. It contains a notice (with portrait) of the President, the Hon. Ira Clifton Copley; an announcement (also with portrait) by the Secretary, Mr. G. G. Ramsdell; and an intimation that the next annual meeting will be held in Atlantic City (N.J.) from the 16th to the 18th of October, at which ten papers will be presented.

Surface Combustion.

Referring to this matter in the new "Bulletin" of the American Gas Institute noticed above, it is said that surface combustion has received considerable attention in America since Professor Bone's lecture; and the "Iron Age" for December stated in part editorially as follows: "Professor Bone came to this country on the invitation of gas-making interests (American Gas Institute) and the information was imparted at first hand at meetings not only in St. Louis, where the achievements were given first publicity in this country, under the auspices of the American Gas Institute, but also in New York, Philadelphia, and Washington. . . . If a correct impression is gained of Professor Bone's own conception of the largest value of surface combustion, it is in its adaptation to steam generation. That there is some reason for enthusiasm in this instance is shown in the performance of a commercial size boiler giving 95 per cent. of the thermal value of the gaseous fuel—bye-product oven gas—in the form of steam produced. The view seems well taken also when it is noted how small, relatively, are the dimensions of the boiler. The short boiler tubes are filled with broken refractory material like fire-brick, though there is the inference that a special refractory material calculated to give the better results is obtainable. . . . In a general way, however, it appears that the discovery is left unfettered for such advantageous use as anyone may wish to make of it; and it is possible that the early future will witness further practical demonstration of its value. . . . It may be that besides adaptation to the industrial field, one will find the accelerated and concentrated combustion with its high temperature and large amount of radiant energy of special advantage for household heating and cooking utensils."

In the remarks made by Mr. J. W. Thornley in the discussion on "Purification" at the last meeting of the Manchester and District Junior Gas Association [*ante*, p. 364], he referred to the sulphur compounds in gas, and expressed the opinion that it would be in the best interests of the gas industry if these could be reduced. He writes to point out that the illustration he took of the objectionable nature of sulphur dioxide was that of an office—not any particular one, as stated; and he also mentioned other places where large quantities of gas are burnt, such as where furnaces, muffles, &c., are used.

ELECTROLYSIS IN UNDERGROUND PIPES.

INSULATION AS A MINIMIZING FACTOR.

By E. B. Rosa and Burton M'Collum.

(*Continued from p.* 221.)

In Table IV. is shown a series of current measurements on lines having insulating joints under conditions where, in most cases, it was not possible to obtain similar readings on lines not so insulated; and they are presented merely to show that, in general, these currents have been found to be very low. These figures may be regarded as typical of what may be expected under ordinary conditions where considerable numbers of insulating joints are used. That the current in these systems was not invariably small, however, is shown in Table V., which gives a number of tests showing currents of considerable magnitude flowing in the pipes. It is to be noted, however, that in all such cases the insulating joints were widely separated, as shown by the column giving the distance from the nearest insulating joint to the point at which the measurements were taken. The distance between joints being at least double these values, they range from 400 to several thousand feet. These figures simply emphasize the fact already pointed out that, if the joints are placed too far apart in places where potential gradients in the earth are high, dangerous currents may be taken up by the pipes.

Table IV.—*Small Currents Flowing in Mains Protected by Insulating Joints.*

Mains.			Joints.		Distribution of Insulating Joints in Mains.	Section in which Drop was Measured.		Average Potential Across Section.	Amperes in Pipe.
Type.	Class.	Size.	Age.	Kind.		Distance to Joint.	Length.		
		Inches.	Years.				Feet.	Millivolts.	
Cast	D	12	Three	Leadite	12 feet	Adjoining	12	−0·013	0·065
,,	,,	12	Three	,,	12 ,,	,,	10½	0·013	0·072
,,	,,	12	Three	,,	12 ,,	,,	11	0·013	0·164
,,	,,	12	Two	,,	12 ,,	,,	8	0·01	0·073
,,	,,	12	Two	,,	12 ,,	,,	11	0·041	0·217
,,	,,	12	Three	,,	12 ,,	,,	11	0·01	0·053
,,	,,	12	Four	,,	Insulat.	,,	10½	0·02	0·112
,,	,,	12	Four	,,	300 feet	,,	11	0·20	0·106
,,	,,	12	Three	Wood	insulat.	,,	6	0·10	0·10
,,	,,	12	Three	,,	,,	100 feet	6	0·30	0·30
Wrot.	Stand.	4	Four	No. 6 D	20 feet	Adjoining	8	<0·0025	<0·0125
,,	,,	6	Four	,,	Insulat.	,,	3	0·005	0·167
,,	,,	4	Four	,,	Irregular	,,	225	0·01	0·26
,,	,,	6	Four	,,	,,	,,	3	0·0025	0·086
,,	,,	4	Four	,,	,,	,,	2½	0·01	0·236
,,	,,	6	Four	,,	,,	,,	1½	<0·0025	<0·196
,,	,,	8	Four	,,	,,	,,	2½	<0·0025	<0·156
,,	,,	3	Four	No. 39 D	20 feet	,,	2½	0·005	0·108
,,	,,	3	Two	No. 6 D	Irregular	1000 feet	10	<0·0025	<0·0125
,,	,,	3	Two	,,	,,	1300 ,,	4	−0·01	−0·104
,,	,,	4	Two	,,	,,	200 ,,	10	0·015	0·088
,,	,,	4	Two	,,	,,	Adjoining	3	0·025	0·075
,,	,,	4	Two	,,	,,	1200 feet	6	0·02	0·197
,,	,,	4	Two	,,	,,	600 ,,	6	0·01	0·098
,,	,,	4	Two	,,	,,	Adjoining	4	0·0025	0·037
Cast	C	6	Two	,,	,,	,,	3½	0·01	0·0595
Wrot.	Stand.	3	Two	,,	,,	500feet	10	0·015	0·062
Cast	C	8	Two	,,	,,	2500 ,,	6	0·20	0·09
Wrot.	Stand.	4	Two	,,	,,	750 ,,	6	0·10	0·098
Cast	C	6	Ten	Cement	12 feet	Adjoining	11	0·0015	0·005
,,	,,	6	Ten	,,	12 ,,	,,	11	0·015	0·028
,,	,,	6	Ten	,,	12 ,,	,,	11	0·05	0·095

Table V.—*Current in Mains when Joints are Infrequent.*

Mains.			Joints.		Distribution of Insulation in Mains.	Section in which Drop was Measured.		Average Potential Across Section.	Amperes in Pipe.
Type.	Class.	Size.	Age.	Type.		Distance from Insulating Joints.	Length.		
		Inches.	Years.				Feet.	Millivolts.	
Cast	D	8	Four	Leadite	Insulat.	Adjoining	9	0·20	0·60
,,	C	30	Three	,,	,,	,,	11	0·20	4·08
Wrot.	Stand.	6	Four	No. 6 D	Irregular	1000 feet	3	0·04	1·39
,,	,,	6	Four	,,	,,	600 ,,	2¾	0·25	8·50
,,	,,	4	Four	,,	,,	300 ,,	2	0·11	3·24
,,	,,	4	Two	,,	,,	200 ,,	19	1·00	3·10
,,	Casing	5⅝	Two	,,	,,	2500 ,,	6	0·05	0·78
,,	Stand.	6	Two	,,	,,	1200 ,,	2	0·40	2·08
,,	,,	8	Two	,,	,,	300 ,,	3	0·60	3·12
,,	,,	4	Two	,,	,,	1200 ,,	2½	0·40	0·25

In all the cases above referred to, the resistance joints were either spaced a considerable distance apart, or were not carefully made so as to ensure a high resistance; and they do not, therefore, show what may be accomplished by the use of insulating joints when installed at very frequent intervals, and when proper care is taken to eliminate defects in the joints. In order to secure further and more exact data on this point, two experimental lines of 4-inch cast-iron pipe were laid at the Bureau of Standards, under conditions which ensured identical treatment except for the joints. The lines were laid parallel, 100 feet long and 40 feet apart; one line being provided with ordinary lead joints, and the other with carefully made cement joints. The arrangements of these pipes is shown in fig. 3. At the centre of each line the pipes were separated by a large insulating plate, and to the ends of the pipes adjoining this plate insulated leads were attached, which were brought to the surface and short-circuited—an ammeter being

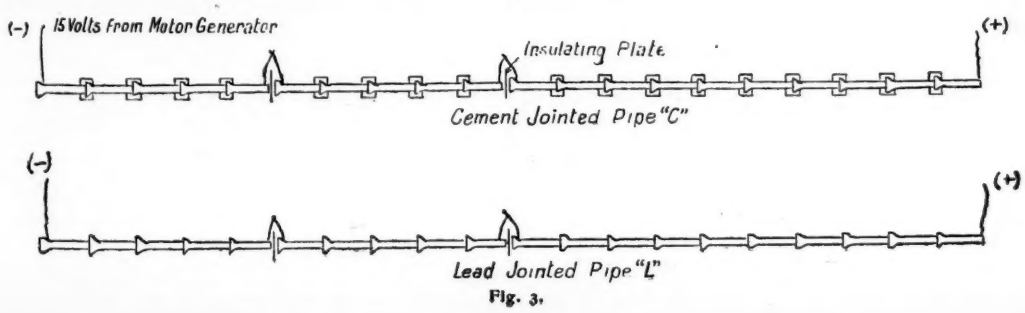


Fig. 3.

inserted in the leads when it was desired to measure the current in the pipes. A difference of potential of 15 volts was impressed on the pipes, and measurements of the current flowing in the pipes were made. The data are given in Table VI. The results are most striking illustrations of the effect of carefully installed insulating joints in keeping currents off pipes. It will be seen that the current flowing in the line provided with cement joints is at present less than the 22,000th part of that flowing in the line having lead joints, and is decreasing. This current is so small as to be entirely negligible in so far as electrolysis effects are concerned.

TABLE VI.—*Current in Parallel Cement and Leadite Lines.*

Date.	Voltage.	Current in Amperes.		Ratio. L/C.
		Cement.	Lead.	
May 8 . .	13 ..	0·0032 ..	29·1 ..	9,100
Nov. 2 . .	15 ..	0·0011 ..	24·2 ..	22,000

It is very important to note that, in the system mentioned above, not only have the currents in the pipes been reduced to relatively small values by means of insulating joints, but the systems thus protected have been singularly free from electrolysis troubles since the joints were installed. Although they have been in service for periods varying from two to ten years or longer, no serious cases of trouble have arisen, although in some instances other systems laid in the same streets, and not so protected, have suffered considerable damage from electrolysis. Very significant in this connection also is the experience of the Cambridge (Mass.) Gas Company, who use cement joints exclusively in their gas-mains, and have had no appreciable trouble from electrolysis, while the water-pipes occupying the same region, and not so protected, have suffered severely for years.

While the foregoing shows that insulating or resistance joints, when properly installed and used in sufficient number, will very greatly reduce the flow of current in pipes, there are certain features in connection with such installations which, if not guarded against, may give rise to considerable trouble. In the first place, joints designed and installed as insulating joints may or may not be insulating when completed; and this is especially apt to be true after the joints have been in service for a considerable length of time. A little carelessness in making the joint may permit the two ends of the pipe to make metallic contact, in which case the joint, of course, becomes worthless as a protection against electrolysis. This is particularly apt to occur in making joints where cement or leadite is substituted for lead. [The authors gave a table showing the resistances of a number of so-called insulating joints in actual service selected at random, which are typical of what may be expected.] In measuring these resistances, a joint and a portion of the pipe were uncovered, and the drop across the joint compared with that across a measured length of pipe, either by means of a voltmeter or with a slide-wire bridge. The size, weight, and material of the pipe being known, the resistance of both pipe and joint in ohms could also be calculated with a fair degree of accuracy. A number of joints showed an extremely low resistance compared with that of an ordinary lead joint; thereby indicating metallic contact of the pipes. This was particularly true of some of the leadite joints, which were made without any attempt to render them insulating; and it was largely responsible for the great proportion of very low-resistance joints. Perhaps the most surprising feature of the table was the low resistance shown by the Dresser couplings, which had been in service for a number of years. With reasonable care in the making, however, all joints, whether made of cement or wood, or some special joint, like Dresser or Hammon couplings, will have ample resistance; and, if properly located and used in a proper manner, any of these joints should prove effective.

Leadite joints, when new, also have ample resistance—comparing favourably with cement joints in this respect. But their resistance appears to decrease rapidly with age. This is very strikingly shown in the following table:

TABLE VII.—*Variation of Resistance of Leadite Joints with Time.*

[A, Current. B, Resistance in ohms.]

	July 7.	July 14.	July 21.	July 28.	Aug. 11.	Aug. 25.	Sept 8.	Sept. 19.
A . .	0·0069	0·0076	0·046	0·268	0·064	0·360	1 24	1·88
B . .	2174	1990	326	56	23	41	12	8

A pipe-line about 100 feet long was laid with leadite joints, care being taken to make all the joints free from metallic contact between the ends of the pipe. At the centre of the line the pipes were separated; an insulating plate was inserted; and the two ends of the pipe on either side of the plate were provided with insulated leads leading to the surface, in which an ammeter could be inserted for the purpose of measuring the current flowing in the pipes from time to time. The arrangement for measuring current was essentially the same as with the cement-covered pipes shown in fig. 1 [*ante*, p. 218]. A difference of potential of 15 volts was impressed on this line continuously, which was sufficient to give a drop of potential of about 0·8 volt on each joint. The readings show that the current was very small when the pipe was first laid, but increased rapidly with time; and after being laid four months the resistances have decreased to about 1-2000th of their initial value, and are still decreasing. At first it was supposed that the apparent decrease in the resistance of the joints might be due to increased leakage around the joints; but measurements made of some of the joints when uncovered show that the resistance of the joint itself has decreased. The resistance of these joints is still high enough, however, to be quite effective in reading currents in the pipes to a safe value under ordinarily severe conditions. But whether they will ultimately fall to so low a value as to render the joints worthless, is a matter that only a long time-test can show; and tests on the joints will be continued till this point is definitely determined.

A condition already referred to that is likely to cause trouble is a too infrequent use of insulating joints; and this condition is probably responsible for most of the disfavour into which this method has fallen in some quarters. Obviously, if the joints are placed far apart, the long stretch of intervening pipe may pick up considerable current; and since most of this must flow out of the pipe as it approaches the insulating joint, serious electrolysis may occur on the positive side of the joint. The more frequently the joints are placed, the less is the danger from this source. It is, of course, impossible to lay down any very definite rules in regard to the frequency with which such joints should be used, since this must be determined in each case by local conditions. In general, however, it may be said that the resistance joints should not be confined to the positive area, as some have supposed, but should be distributed throughout the negative and the neutral areas also. All lines which run near, or cross under, street railway tracks are generally most in need of resistance joints.

In many cases, where there is good reason for believing that the drop of potential is fairly uniformly distributed throughout the entire region in which the insulating joints are to be placed, it is sufficient simply to determine the total difference of potential between the ends of the line affected and use this value in determining the number of insulating joints that are needed in order that the drop of potential across each joint shall not exceed a predetermined value. It often happens, however, that the potential gradient may vary greatly in different portions of the line; and if the joints were uniformly spaced in such cases, the joints would either be more frequent than necessary in some places, or too few in others, and the condition of maximum protection at a minimum of cost would not be realized. This condition is very likely to occur where a pipe-line runs at right angles to railway lines, in which case the potential gradient along the pipe will often be many times greater at points within a short distance on either side of the track than at more remote places. Other conditions, such as the presence of other pipe systems, may also disturb the uniformity of the potential drop.

In some instances, as in laying new lines where some cheap type of joint is being used, it may often be cheaper to allow a liberal factor of safety, and instal enough joints to be safe under any conditions that may arise. But in other cases—as, for instance, where insulating joints are to be inserted in large and important mains already laid, where the cost of the joints is an important matter, and where interruption of the service is a matter of serious moment—it is important that no unnecessary joints be used, and that these be so placed that they will be most effective in reducing the flow of current in the pipes, and so there will be no danger of developing a difference of potential high enough across the joint to cause trouble. For this reason, before attempting to instal a series of insulating joints for the purpose of preventing electrolysis, in cases where it is desirable, for economic or other reasons, to use as few joints as possible, it is important first to make a careful potential survey of the district to be affected, and determine the magnitude of the potential gradients in a direction parallel to the pipe-lines. This will enable one to determine in advance the approximate number of joints that will be necessary, and also the proper location of the joints, so that the drop of potential across any joint may not exceed a certain amount. If a new line is to be laid, it is safe to assume that the average potential gradient after the pipe has been laid will not differ greatly from that which prevails beforehand, provided the joints are used at proper intervals; but the distribution of this potential gradient will be greatly altered, as practically all the fall of potential occurs at the joints. The average drop of potential across joints in any given portion of the line will be approximately equal to the total drop divided by the number of joints. When insulating joints are to be placed in old lines, it is well to bear in mind that the insertion of the joints in the pipe will, in general, increase the potential gradient along the pipe. This increase may reach as much as 100 per cent. or more; and allowance should always be made for it.

In actually measuring the potential gradients in the earth, special precautions must be taken if trustworthy results are to be obtained. Some form of non-polarizable electrode must be used, and so designed that the resistance of the earth immediately surrounding the electrode will not produce a drop of potential under the flow of the voltmeter current large enough to affect seriously the readings of the instrument. To accomplish this, the surface area of the non-polarizable terminal should be large, and it should be used in connection with a high-resistance voltmeter having a high current sensibility. An electrode which we have found to be satisfactory for this purpose is a modified form of the Haber. A wooden rod, about 3 feet long and 1 inch diameter, is provided at one end with a copper sheath about 6 or 8 inches long. To this sheath an insulated wire is connected and carried up along the rod to be used as connection to the voltmeter. The copper sheath is then placed in a cylindrical porous enclosure somewhat larger than the sheath, and the intervening space filled with copper sulphate crystals. Hollow cement cylinders, about 2 inches in diameter and slightly longer than the copper sheath, have proved satisfactory for this purpose. Two of these electrodes are used; and when it is desired to measure the difference of potential

between any two points in the earth, holes are drilled into the earth at the desired points, to a depth of about a foot or more, by means of a crowbar or other suitable tool, and these filled with copper sulphate solution or water, into which the non-polarizable electrode is immersed to a depth sufficient to cover the copper sheath. The insulated copper leads being connected to the terminals of a suitable voltmeter, the difference of potential can be determined, which will be practically free from errors due to polarization.

After a series of joints are installed, the only method of determining experimentally whether or not a sufficient number of joints have been installed is by measuring the drop of potential across each joint and by measuring the flow of current in the pipes. If the joints are too few in number in any locality, there will generally be too high a voltage across the joints; and thus the consequent heavy leakage current may injure the pipe on the positive side of the joint. The voltage that can be safely permitted is a matter which depends on a variety of conditions, such as the nature of the soil, the kind of joint used, &c., and can only be roughly indicated here. Careful observations of joints under average conditions for a considerable period, together with laboratory experiments to be given later, indicate that a drop across the joint of from 0·1 to 0·4 volt can usually be regarded as safe. The lower limit applies to pipes located in low wet places, and to joints having a short leakage path between the sections of the pipe, and the upper limit to pipes in comparatively dry soils and to joints having a long leakage path. This matter of the length of the leakage path around the joint is an important one, and is treated at some length later in discussing the relative value of different kinds of joints. If the joints used have not a very high resistance, as when leadite is used, for instance, considerable current may flow through the joints without making a dangerous drop across the joint, and the currents thus collected in a large number of branch lines may ultimately be carried to a few lines in a remote quarter and there give rise to serious damage. As to whether current flowing through the leadite involves danger to the joint has not yet been determined. In order to guard against this, current measurements in the pipes should also be made. If in any line any considerable current is found to be flowing, or if the voltage across the joints exceeds considerably the limits mentioned above, additional joints should be installed.

One of the problems encountered in attempting to protect a pipe system by the use of resistance joints is the effect of other pipe systems in the same territory not so protected. Gas and water systems, for instance, are often brought into metallic contact with each other in many places, and this greatly increases the difficulty of protecting either system alone by the use of resistance joints. This difficulty could be largely avoided by inserting an insulating joint in the service-pipe inside the building in which metallic connection with the other system is made. There are other complications, however, which are not so easily dealt with; and where an uninsulated pipe system occupies the same territory with an insulated system, isolated cases of electrolysis are likely to occur.

When a line having insulated joints must be connected to another line not so insulated, trouble may be experienced due to the tendency to develop with potential drops across the joints in such places, particularly if the uninsulated pipe-line is at a potential considerably different from that of the earth, either positive or negative. This condition is especially likely to occur if the uninsulated main is connected to negative return feeders, and those insulating joints which connect the insulated lines to those having the negative feeders attached are often subjected to unavoidable differences of potential that may be sufficient to destroy the joint in a very short time. For this reason, the use of insulating joints and of negative return feeders in the same system is not to be recommended.

The difference of potential that can safely be permitted across a joint presents a problem of great importance, and one to which comparatively little study has been given. Some of the factors governing this have been mentioned; and one of the most important of these is the type of joint used. It is well recognized that the actual damage due to the discharge of current from a pipe does not depend much on the total quantity of electricity discharge, but mainly on the distribution of the discharge. If the current leaves the pipe uniformly over a large surface, a much longer period must elapse before serious damage will result than if the intensity of current discharge is much greater at some points than at others; so that condition which tends to prevent concentration of discharge will correspondingly reduce the danger. As already shown, pipes, even when provided with insulating joints, will carry some current; and especially if the joints are not very frequent, considerable current may be found. Since with high-resistance joints most of this current must leave the pipes at every joint, it becomes important to determine as accurately as possible what the distribution of this discharge may be, and find how this distribution may be made most nearly uniform.

To determine something of the effect of the form of the insulating joint on the distribution of current around the joint, three perfectly insulating joints were made of 4-inch cast-iron pipe—one a bell-and-spigot joined by paraffin; the second, a butt-joint with ½ inch of paraffined wood separating the pipes; and the third, a similar butt-joint with 5 inches of paraffined wood between the pipes. The arrangement of the apparatus is shown in the accompanying figure.

The pipes in succession were placed co-axially in a cylindrical

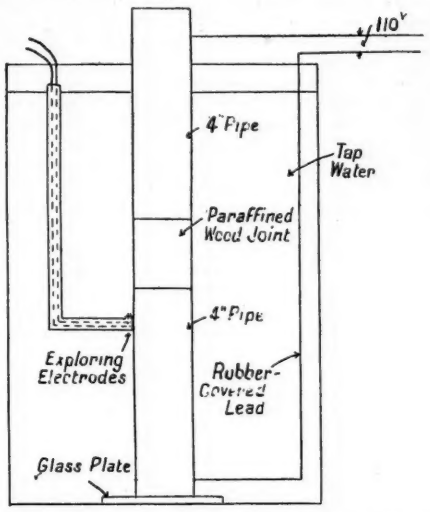


Fig. 4.—Apparatus for Exploring Current Distribution at Insulated Joints.

tank of water, 23 inches in diameter, and 32 inches in depth, with the joint near the centre of the tank. The bottom of the tank was covered with a layer of paraffin; the end of the pipe resting upon a glass plate. Rubber-covered leads, attached to the pipes 14 inches from the joints, permitted the impressing of voltages from 4 to 11 volts. An L-shaped two-conductor rubber-insulated cable was lowered into the water, the plane of the L being kept radial to the pipe, and the end bent upwards so that the line joining the exposed ends of the wires at the terminal of the L was normal to the surface of the pipe. Since the specific resistance of the water was substantially uniform throughout, the potential gradient at any point was proportional to the intensity of the current at that point, so that by measuring the difference of potential between the two exposed ends of the wires, when placed as close as practicable to the surface of the pipe (about 0·04 inch), the potential gradients thus obtained, divided by the specific resistance of the water, gave the intensity of the current at that point; and by raising or lowering the L, the intensity of the current discharge at any point could be found. It was necessary to impress rather high voltages across the joint, in order that the potential difference between the terminals of the L should be sufficiently large that the reading would not be seriously affected by polarization at the terminals. From 20 volts to about 100 volts were used, according to the type of joint under test. The results of the tests are very strikingly shown in the curves of the next diagram, in which the intensity of the current discharge is plotted as a function of the distance along the pipe on each side of the joint. The axis of the pipe is taken as the zero axis of current, and positive values represent the flow of current away from the pipe; while negative values represent the current returning to the pipe. For convenience in making comparisons, all readings are reduced to values corresponding to a difference of potential of 20 volts across the joint. The curves indicate that the form of the joint has a most decided effect on the distribution of current discharge. The bell-and-spigot type shows a very high density of current just under the edge of the bell—indicating a

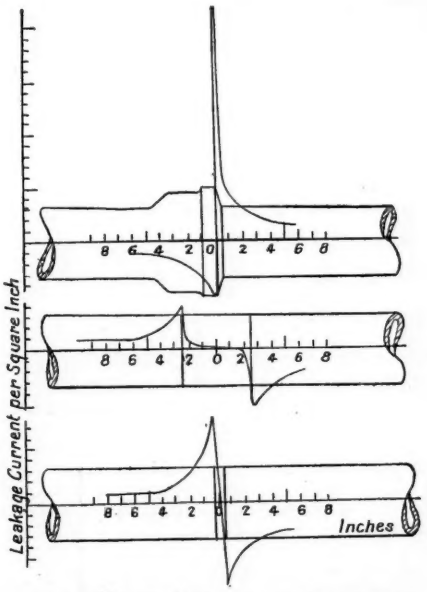


Fig. 5.—Curves showing the Effect of Various Insulating Joints on the Distribution of Leakage Current around the Joints.

very high rate of corrosion at that point. The butt-joint, shown at the bottom, having a length of ½-inch, shows a much better distribution of current; the maximum intensity being about one-third that in the case of the bell-and-spigot joint. With the joint 5 inches long, still further reduction in the height of the peak is shown; the maximum intensity of discharge being only 15 per cent. of that of the bell-and-spigot type. It is also very interesting to note that the total flow of current about the joint does not differ greatly in the three cases; the resistances of the leakage path being 68, 72, and 87 ohms in the bell-and-spigot ½-inch and 5-inch joints respectively. Particularly significant is the comparison of the two butt-joints in this respect. Although one is ten times as long as the other, the resistance of the leakage path is increased by less than 30 per cent. This shows the unwisdom of attempting to reduce the flow of current in a pipe-line merely by increasing the length of a few joints. The short joints are, as a rule, much cheaper and easier to instal; and they can therefore be installed much more frequently for the same total cost.

As a rule, therefore, it would appear preferable, in installing a line of insulating joints, to use a large number of short joints rather than a few long ones, as in this way the current in the pipes can be kept at a much lower volume, and the relatively large number of joints will usually be sufficient to prevent any serious potential drop across the joint. In some cases, however, as where the insulating joints are discontinued, or where, for any reason, it is desired to use but a few joints, or to put them in places where high-potential differences are unavoidable, the above tests show that the long joint is much to be preferred, because of its effect in preventing great concentration of current discharge near the edge of the joint.

The above data furnished also a basis upon which a roughly approximate determination can be made of the voltage drop which may be permitted across a joint of the types tested. It can be shown that the rate at which corrosion will penetrate the iron is given by the formula $L = \frac{C}{D} \times \frac{P}{S}$, where L is the rate at which the corrosion penetrates the iron, expressed in centimetres per annum, C is the electro-chemical equivalent of iron, D is its density, P is the average potential gradient in volts per centimetre normal to the pipe at the point considered, and S is the specific resistance of the iron in ohms per cubic centimetre. The assumption is here made that the efficiency of corrosion is 100 per cent. For cast iron, the value of $\frac{C}{D}$ is about 1280; and the equation becomes $L = 1280 \cdot \frac{P}{S}$. Assuming 5600 ohms per cubic centimetre as the specific resistance of the soil, and a drop of potential of 0·4 volt across the joint, and determining from the curves (fig. 5) the current maximum intensity reduced to this voltage, in the preceding diagram we get as the maximum rate of penetration of the corrosion in inches per year: Bell-and-spigot joint, 0·034; ½-inch wood joint, 0·009; 5-inch wood joint, 0·004. The years required for the corrosion to penetrate clear through a pipe of ½-inch thickness containing these joints is, therefore, as follows: Bell-and-spigot, 14·7; ½-inch wood, 53·4; 5-inch wood, 121. The permissible drop across a joint in ½-inch cast-iron pipe for a life of forty years is as follows: Bell-and-spigot joint, 0·147 volts; ½-inch wood, 0·53 volts; 5-inch wood, 1·22 volts.

In considering these figures, it is well to remember that the corrosion here indicated is that due to electrolysis, and is in addition to the corrosion due to the soil or water. It should be added that we have found specific resistance as low as 1100 ohms per cubic centimetre; and under such conditions the rate of corrosion may be five times that computed above. Further, the effect of surface resistance due to points, &c., and the effects of polarization under low voltages, are not considered here; so that large variations from the calculated values may be expected. These calculations are of use only in this respect, that they indicate that a drop of potential across a joint can hardly be considered safe if it exceeds a few tenths of a volt, and that much can be gained by the use of a long leakage path where voltages are expected to be high. This problem is an important one; and much additional work remains to be done in this direction.

(To be continued.)

COMPARISON OF DAYLIGHT & ARTIFICIAL LIGHT.

The Lighting of Schools.

In his fifth lecture at the Regent Street Polytechnic last Thursday, Mr. J. S. Dow alluded to the chief differences between daylight and artificial light. He pointed out that most of the work of the present day is still done by daylight; it is therefore essential to study as carefully the admission of daylight into rooms as artificial illumination. It must, he said, also be remembered that there are many buildings—libraries, museums, picture galleries, &c.—which are only open in the daytime. The importance of daylight is also recognized by sanitary and factory inspectors. Quite apart from the use of natural light for illumination, it is essential to health. The Italians have a proverb: "Where the sun does not enter the doctor comes;" and it is a fact that underground basement premises (such as those in which baking is often carried on) are apt to be unhealthy. Sunlight serves to destroy germs, and has probably direct beneficial effects on the body in other respects.

The next point to which attention was directed was the extreme variation in daylight conditions. The shadows and quality of illumination when there is a clear sky and direct sunlight are vastly different from those prevailing in cloudy weather. Daylight illumination in a room lighted by windows down one side is very far from shadowless or uniform as is sometimes supposed. On the contrary, the variation is often far greater than by artificial light. The illumination in a room during the day depends upon (1) the time of year, (2) time of day, (3) special climatic conditions prevailing, (4) window area and position of windows, (5) the amount of sky visible from windows, and the reflecting power of the surrounding buildings, (6) dimensions and shape of the room, and (7) the lightness of the scheme of decoration.

To illustrate these points, Mr. Dow threw on the screen several slides showing the average variation in daylight during the year and at different times in the day. He said the London Building Act of 1894 had specified that the ratio of window area to floor area should be at least 1 : 10; and in subsequent regulations for the London County Council schools 1 : 5 had been specified. Professor L. Weber had also advocated that this ratio should be multiplied by a factor expressing the "light-value" of a window—*i.e.*, the proportion of area open to the unobstructed sky. The modern school-rooms of the Council were schemed out with maximum window-space on the left of the children. With a view to improving the uniformity of illumination from side windows, it was specially important to use a light scheme of decoration for walls and ceiling.

Mr. Dow then referred briefly to the value of photometric methods in studying daylight illumination and in connection with "ancient light" cases—a matter on which he had touched in a previous lecture. He also threw out some suggestions showing how the probable distribution of light in a room with a certain aspect could be calculated beforehand with fair accuracy. Instead of calculating these values, however, he said it was also possible to construct a rough cardboard model of the room, and make an artificial sky by illuminated tracing-paper, &c.; and thus, by photometric measurements, obtain a forecast of what the daylight conditions would be. Such methods, he thought, might be found of considerable value by architects. In Germany and the United States the proposal had been made, and, he believed, acted upon, that before any new school was built there should be a consultation between the architect, the lighting engineer, and the medical officer. Mr. Dow again summarized his previous remarks on the extreme variation in daylight conditions; pointing out that artificial illumination is much better under control. One ought, therefore, not to follow daylight conditions too closely, but aim at reproducing its best features in artificial lighting.

The lecturer then passed on to discuss briefly the points to be considered in planning artificial illumination. The comparative costs thrown out for different illuminants, he said, had almost invariably to be modified considerably by local circumstances; and he instanced several occasions on which this had occurred. In designing an installation, it was necessary to consider what a room was to be used for, and where the light was most needed. In many cases (goods yards, packing-rooms, and workshops in which a number of people worked constantly side by side), it was desirable to flood the whole room with even illumination. This could be done effectually either by indirect lighting from a powerful central source or by distributed small units. In other cases, local lighting—*i.e.*, the concentration of light at certain places—and the provision of a moderate general illumination were demanded. In any case, it was most essential to place the lamps so that the glare of rays shining straight into the eyes was avoided. The light should illuminate the work, and should be both sufficient in quantity and come from the right direction. For writing, light coming from the left hand was advisable; light from the right threw inconvenient shadows. The avoidance of head-shadows had to be specially guarded against in school-rooms and in drawing offices; and indirect illumination, with its absence of very marked shadows in one direction, was often very serviceable in such cases. A special instance of the importance of properly directed light was given in connection with cutting-tools in tailoring work, &c.; as want of attention to this point had often led to spoiled work, as well as to accidents to fingers. One had also to decide definitely how much illumination was needed for specific purposes, and what proportion of the light provided should be devoted respectively to walls, ceiling, and working plane.

In describing installations, it was, Mr. Dow said, becoming usual to specify the illumination provided at the working spot, such as the table, desk, bench, &c.; the diversity factor—*i.e.*, the ratio of maximum to minimum illumination over the area lighted; the approximate surface brightness of surroundings; and the consumption of gas or electricity per square foot of floor area. Naturally, such rules had limitations; but, in conjunction with photographs taken by the light of actual sources, they probably gave the best ready method of describing an installation.

Such general rules were necessarily rough, and limited in application. They were, however, often useful in forming a rapid estimate of the cost of lighting a certain room. Mr. Webber, in his book on "The Science and Practice of Lighting," suggested the allowance of 1-candle power for every 3 square feet of area lighted. By examining data presented before the Illuminating Engineering Society, he (the lecturer) had found that, with average well-lighted installations, using tungsten lamps and "Holophane"

reflectors, one secured 2 foot-candles with a consumption of about 0·5 watt per square foot; while with indirect arc lighting the illumination might be about 6 foot-candles with 1·5 watts per square foot. By both methods, therefore, one could expect to obtain satisfactory results by the expenditure of about 25 watts per foot-candle per 100 square feet of area illuminated. In the same way, data given by Mr. J. G. Clark, of the Gaslight and Coke Company, and by German authorities for schools lighted by good low-pressure incandescent gas methods, showed that one obtained about 2 to 4 foot-candles with from 1½ to 5 cubic feet of gas per 100 square feet of floor area illuminated; whence one might derive the rough rule that, for satisfactory general low-pressure incandescent gas lighting, 1 cubic foot of gas per foot-candle per 100 square feet of area illuminated would be needed.

These data were founded, Mr. Dow explained, mainly on results in schools lighted by gas or electricity for which abundant information was available. The rules were, he repeated, very rough. Naturally they could not be applied indiscriminately to all cases, and indeed really only applied to general lighting. He knew of cases in which considerably more favourable results had been obtained with both gas and electricity, and others in which more expenditure had been necessary owing to specially strong wall illumination or other circumstances. The preceding formulæ said nothing on the amount of light distributed on the walls; but a room illuminated in accordance with the figures could usually be made to appear quite sufficiently bright.

In the concluding part of the lecture, Mr. Dow dealt exclusively with school lighting; pointing out the distinction between different classes of schools and colleges, and the number of special problems to be met in lighting class-rooms, lecture theatres, drawing offices, &c. A considerable number of slides were thrown on the screen—most of them summarizing the results of investigations in London schools and colleges presented before the Illuminating Engineering Society. A series of views of schools illuminated by indirect arc lighting, kindly lent by Mr. T. E. Ritchie, of the Union Electric Company, and finally a number of photographs of schools lighted by the Gaslight and Coke Company, kindly lent by Mr. Clark, were included. The lecturer drew attention to the good and bad points in the various installations, indicating the improvement secured by using the most up-to-date inverted mantle units for school lighting.

In conclusion, Mr. Dow summarized the recommendations derived from this discussion; suggesting that at least 3 foot-candles should be provided on the desks, that special care should be taken to keep bright lights out of the direct range of vision of scholars and teachers, and that specially strong illumination on the blackboard and the lecture-table was desirable.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

A General Meeting of the Association was held in the Glasgow Technical College on Saturday evening—the PRESIDENT (Mr. James M'Ghee) in the chair.

Mr. R. B. LECKIE (Holytown) read a paper on the

EXPERIENCES OF A MANAGER IN A SMALL GAS-WORKS.

At the outset, the author said it would not be out of place to give a short description of the works with which he was associated, as the plant had naturally to be taken into consideration when viewing the small difficulties and the most effective means of getting rid of them. The Holytown Gas-Works, which supplied the villages of Holytown and New Stevenston, were not placed in the best possible position. Being situated fully a mile from the nearest railway depôt, the cost of the coal in the works was thereby greatly affected. The works at Holytown were 345 feet above sea-level—55 feet above sea-level of New Stevenston; and this was far from helping in the production and selling of gas at a cheap rate. They were, however, placed in close proximity to four large towns, one of which, he believed, sold the cheapest gas in Scotland. This was one of their worries, as they were being constantly reminded of what their neighbours could do. Their price of 3s. 9d. per 1000 cubic feet was, for the size of the works (only 8 millions per annum) not out of reason; but, with the prospect of an early reduction to 3s. 4d., he thought things were going well with them. The district was a growing one; the output of gas having doubled itself in seven years.

Regarding the works, the retort-house was 30 ft. by 45 ft.; and the retort-bench consisted of two ovens of five and one oven of two retorts. The second oven of five was built last summer, and, like the other two, was on the regenerative principle. The bench was built close against the back gable and one wall of the house, which had proved a costly mistake. To economize, when the bench was erected in 1901, there were no binders fixed at the back; the tie-rods from the three front binders being simply carried through the wall, and screwed up against the iron plates, 12 inches square. The natural result was that not only the bench but the whole gable bulged to a dangerous degree. They had also to be continually pointing-up the cracks in the brickwork. To remedy this, it was decided, while building the new oven, to erect binders, and tie the bench securely together. The binders were sunk in good foundations, and the tie-rods lengthened to suit. At the same time, they put two sets of horizontal binders, consisting of channel-irons, 6 in. by 3 in., between each vertical binder, with a heavy angle-iron stay at the corner of the building. Everything was connected together, and the whole of the stays tightened-up as far as was considered safe. But, of course, there could be no hope of bringing the walls plumb. The experience proved that the policy of economy of ten years ago was false.

Previous to the erection of a new coal-store for 140 tons, a portion of the retort-house had to be used for storing coal; but as only three days' supply could be kept, they were forced to store most of the stock outside. Up to the time of these extensions, the only method of quenching the hot coke was by the flow of water from a ½-inch hose-pipe. As the waste of water by this means was very large, an effort to economize in this direction was tried. Two tanks, built of brick and rendered with concrete, were constructed—the smaller tank for catching the silt and dirt from the coke, and the larger one for storing. The water which formerly went to the drains was lifted by means of a steam water-raiser to an overhead tank, which gave a flush of water sufficient to cool the coke in a very short time. The overflows from the tanks of the gasholders were led into the storage-tanks, and during the past winter very little water was taken from the county mains—in fact, they estimated that before the end of their financial year they would have saved enough to cover the cost of the tanks.

The exhauster, put in two years ago, was capable of dealing with double the maximum make; and the condensers were also of ample size. The purification plant consisted of a tower scrubber 18 ft. high and 4 ft. by 6 ft., and two purifiers 10 feet square and 5 feet deep inside, having four tiers of grids. There were two gasholders—one spiral-guided, 50 feet in diameter, and working in a steel tank; the other column-guided, 35 feet in diameter, set in a brick tank. The total storage capacity was 42,000 cubic feet. The unlagged vertical steam-boiler was placed in the retort-house; and, besides being used for driving the exhauster and the liquor-pump, it provided steam for the holders during frost.

With regard to the retort-bench, the mouthpieces on the old settings were lime-luted; but they had fixed self-sealing mouthpieces on the new ones, and this helped greatly in keeping the retort-house clean and tidy.

Mistakes, he held, were much more easily rectified in large, as compared with small, works. He would like to mention a saving they effected in Holytown. In connection with the scrubber was a small vertical steam-engine, which was kept constantly pumping the liquor to the top of the tower, until it reached the strength required. The pump was fixed in the exhauster-house, in a most inaccessible corner. On removing this to the outside of the house for better supervision, they decided to connect it up with the underground liquor well; and by the suitable arrangement of four valves and a delivery pipe fixed in a bracket from the wall, they were enabled to fill all the ammoniacal liquor into barrels by means of this pump. Previously the liquor had to be pumped by a hand pump. The only drawback was that they did not get the full value of the scrubber while filling the casks.

Lime was solely used for purification purposes; and by the admission of a small percentage of air, they had been enabled to greatly reduce the purifying costs. When he first took over the management of the works, the system was to draw in the air through a wet meter by means of a steam-injector. The meter was placed in an old window of the retort-house, and the air was drawn in at the inlet of the condensers. Fixed to the outlet of the meter was a back-pressure or check valve, which prevented the gas passing back through the meter in the event of back-pressure arising. During frost they had continual trouble with the water in the meter freezing. Added to this was the trouble they experienced with the chemical company who had their liquor contract. They complained, and advised him that unless the strength of the liquor was kept up to a reasonable figure, they would refuse to take delivery. In his opinion, the low strength of the liquor was caused by the condensed steam, which greatly affected the Twaddel hydrometer. To cure this, a rotary blower was installed, driven from the pulley on the exhauster engine. At the same time, they fixed the air-meter beside the blower in the engine-room. This so far was satisfactory. To save a long piece of overhead pipe to the condensers, the inlet to the exhauster was made the point of introduction. Unfortunately, the purifiers, which had previously been running without changing for over two months, fouled about every week, which was as often as before the admission of air was tried. They then went back to the old method of putting air in at the condensers, and had no further trouble with the purifiers. The only reason he could put forward for this was that, as the distance from the exhauster to the purifier was only 15 feet, the air had not sufficient time to thoroughly mix with the gas before being rushed through the lime. Certainly the illuminating power of the gas suffered considerably during this time.

By revivification they were able to use their lime for a second time. After the first fouling, they had the lime spread out in an even layer, as was done with oxide. Their experience was that by working the second box (which had been previously the clean one, but was partially fouled) as the first, and filling the second with revivified lime, they had much better purifying results than by using fresh lime for each purifier.

Discussion.

Mr. T. ORR (Motherwell) referred to the grievances of the managers of small gas-works. He said applicants in a recent vacancy were required to tabulate their working results; and

he submitted that this was not a fair way of judging candidates' abilities. He also alluded to the petty jealousies existing in country villages or towns, which led to the gas manager being accused of favouring certain of the consumers. There were people who were always ready to say that the consumers belonging to the manager's church got the best meters.

Mr. W. M. Mason (Glasgow) held that the man who was managing a small concern could get more valuable experience for his future than the employee who was engaged in a large concern, such as that at Glasgow. Some of them knew all about meters; others knew about selling things, and others, again, knew about general management. But Mr. Leckie had to do the whole thing himself. He had said that unfortunately one of his near neighbours supplied the cheapest gas in Scotland. Glasgow, too, had had this thrown in their teeth. He thought the man in a small place had this advantage, that if he made it a success he, as manager, got the whole credit.

Mr. John Frazer (Provan) remarked that the altering of air from the condenser to the exhausters being such a short distance, he failed to see it made any material difference, other than that Mr. Leckie had put it into the front of the condenser. This was the only exception. Many people introduced air into gas where there was lime purification; and according to what Mr. Leckie had said it was beneficial. He (Mr. Frazer) would like to know if the author could give any figures showing what was really obtained in regard to the percentage of air admitted into the gas. He was astonished at Mr. Leckie's remarks as to the revivification of the lime; and he instanced a case where the results did not justify the labour expended. He should like some information as to the depth of the lime in each tier, and the condensation that was in them. He found in Provan, after working with two tiers of lime, that they were very heavy in comparison with many cases. They used to work with a heavy bed of lime at the bottom, which was supposed to give the best results; and condensation was very heavy. They altered the heavy bed from the bottom to the top, and minimized the condensation. They found that, by getting the heavy bed of lime to the top, not only was there less condensation, but that the spent lime was more solid when taken out of the boxes.

Mr. G. Braidwood (Glasgow) wished to know if Mr. Leckie had any knowledge or experience as to the percentage of oxygen passing into the gas and going into the holder, and if he had had any consequent trouble from corrosion in his station meter, gasholder, or the services in his district.

Mr. J. Wilson (Falkirk) found, as did other speakers, that the manager of small gas-works had a more interesting time than one in charge of a large concern. He said he himself had been for some time in small works, and had had his own little trials and troubles; one being that they could not get their retorts to work. The matter became so bad that they had to do something. They tried to find out what was wrong with the heating apparatus, and ultimately they discovered that the flue running along the back end of the chimney had, through the course of years, become opened up and cracked, and that they were completely losing the draught. They had the cracks filled up, and had no more trouble.

Mr. David Fulton (Maryhill) said he was astonished and amused at Mr. Leckie's frank avowal of admitting air into gas. He (Mr. Fulton) took air through the meter, and knew the percentage, and from this could easily find out how much oxygen was in it. He thought it was wise on the part of Mr. Leckie to store his coal inside. He had seen it stated that nothing was more severe on coal than the drip of water from the roofs.

The President said he was interested in the lime question, and wished to know if the author used the Irish or Scottish variety. He would like to know Mr. Leckie's experience as to the nature of lime, and whether Scottish lime was at the top of the tree. Did Mr. Leckie stimulate consumers in the district by giving free apparatus or hiring-out at cheap rates?

Mr. Leckie, in replying, said that when he went to Holytown the idea of purification by lime and the admission of air which had been tried by his predecessor was working quite successfully. The quantity of air they put in was 3 per cent., but it varied down to 2 per cent. Unfortunately, those who entered the works and sometimes saw the blower going would spread such a rumour as "that they were blowing air into gas." He had found that in one works near Holytown lime was being revivified; and seeing the results, he tried it for himself. Their purification cost them 0·43d. per 1000 cubic feet. In the period of four months in which they revivified lime, he believed it would turn out as cheap as oxide. They did not go to the expense of burning the lime. At a push, the lime had been thrown out and put back from the heap. They had nothing to do with the lighting of the town.

Mr. Frazer said he was still at a loss to know how spent lime, even when spread out, could be revivified. In regard to the strength of liquor, he thought Mr. Leckie would be well advised to pump this liquor back to the hydraulic main, and use it over again. They had done this in Provan.

Scottish Junior Gas Association (Western District.)—We learn from the Hon. Secretary and Treasurer (Mr. W. Geddes) that the first visit of the Western District Section of the above-named Association for the present session will take place next Saturday afternoon to the Granton works of the Edinburgh and Leith Gas Commissioners. After the inspection, the visitors will be entertained at tea in the technical office.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

What was the Cause of the Ilkeston Catastrophe?

Sir,—While humanity in general revels in a mystery, engineers have cause for serious reflection when anything happens to their structures, the cause of which they are unable to determine.

I have read with considerable interest the evidence of the experts in the inquiry before the Coroner's Jury in the above case, and also the very able article by Mr. Norton H. Humphrys, under the above title, in the "Journal" for the 6th inst. A portion of this article prompts me to recount an incident which may assist those who have had the opportunity of close personal inspection of the results of the accident to an elucidation of its cause.

A large four-lift holder was inflated to the extent of three lifts, and just cupping with the fourth, when, to the surprise of those in charge, the holder descended to the extent of two lifts at a run; and, as soon as the inner lift cup was immersed, it came to rest without injury. Needless to say, such a startling occurrence caused me to give close consideration as to the cause. I had the holder inflated gradually under observation. The inner lift cup ascended—bringing with it its neighbour lift; and, as far as observation went, no leakage whatever could be detected from the cup. After standing for some period, the holder was further inflated and still closely watched. There was no question as to the amount of water in the upper cup just before the incident, as the holder had been recently down, and neither wind nor other conditions had prevailed to account for loss in this way. One thing was clear as to the cause. The upper cup had "blown its seal." This being actually observed by the descending water.

After every other possible source of leakage from the cup had been investigated, it was found that an anti-freezing device (consisting of a steam injector with its flexible tube, which was then uncoupled from the steam-pipe) had, by some means—probably due to flooding as the fourth lift was picked up—become charged, and, acting as a syphon, had drawn out sufficient water from the cup to permit of the pressure, when the fourth lift was cupped, blowing throughout its circumference. The holder naturally descended at a highly rapid rate, fortunately, in its vertical guides attached to the external guide-framing, without damage or without injury. The incident I refer to occurred some years ago, and nothing was done to the structure at the time; the holder having worked perfectly both before and after the occurrence.

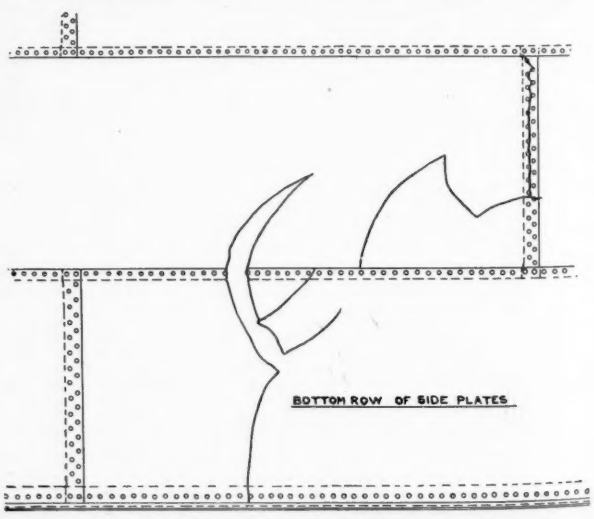
With these facts in my mind, it naturally occurred to me, at first reading the particulars of the accident at Ilkeston, that some such occurrence might have been the cause of the accident. The rapid descent of the holder, as a consequence of losing gas at the cups, would throw an enormous strain on the spiral guides, and by tilting might reasonably bring about the rupture at the point exhibited in the drawings by Mr. Bell. The jambing of the lower lift would not retard the ultimate fall of the inner lift; and as there appear to have been two incidents with regard to ignition, there seems to be some ground for such a suggestion.

W. R. Herring.

Palace Chambers, Westminster, S.W.,
Feb. 8, 1912.

Sir,—The particulars published in this week's "Journal" are most useful, and give considerable food for reflection. Personally, however, I am convinced that Mr. Hallam's account (as mentioned in Mr. Norton H. Humphry's article), that the tank burst first, is correct, and the collapse of the gasholder an after-effect, which would have happened just the same if it had been an ordinary standard-guided holder, instead of a spiral gasholder.

Notwithstanding all that has been written, I do not think it can be said to be proved that the holder locked first, causing an escape of gas and the tank burst due to the unusual strain caused by this locking and running-down of the lifts. Were the position and condition of the two lifts after the disaster in any particular incompatible with the theory that the tank first burst asunder and the holders then fell, at the same time floating away with the outflowing water until they stranded? It will be noticed by the illustration that the inner flanges of the rollers



Approximate Sketch of Cracks or Tears in the Side Plates on the Opposite Side to the Main Break.

—*i.e.*, nearest the rails—are much less in diameter than are the back flanges, from which it would be seen that it would not require a very great strain to pull the rail out of gear with the rollers.

I think further investigation will prove that the tank burst from the bottom upwards—due to the brittleness of the lower tier of tank side-plates. The way in which the plates burst, and also the way in which the two bottom tiers of side-plates are cracked—cast iron fashion—where they came in contact with the surrounding wall on the opposite side to Belfield Street [see sketch] clearly points to this; and before this matter is allowed to drop, I think the $\frac{9}{16}$-inch thick plates also ought to be tested. Why was only the $\frac{5}{8}$-inch thick plate tested, which is only a middle plate in depth?

A further reason for assuming that the bottom side-plates were brittle is that the rivet joint is, according to calculation, weaker than the plate joint; yet the rivets have stood and the plate has torn or rather cracked.

The writer, who has had considerable experience in the working of spiral-guided gasholders, totally disagrees with Mr. Bell's remarks that spiral-guided holders require more attention, or that the rollers require more adjustment than an ordinary column-guided gasholder. Such is not the case. The very construction of spiral holders must prove that, once the guide-carriages are properly adjusted (due allowance in the manufacture being made for expansion, which is quite an easy and simple matter), they never afterwards require adjusting.

Spiral-guided gasholders are steadier in gales than ordinary holders, as every user will agree; and they are certainly safer in snow storms and other severe conditions.

A SEEKER AFTER TRUTH.

Feb. 9, 1912.

SIR,—I notice in the description of the Ilkeston holder and tank in the last "JOURNAL," the concrete under the tank is figured 2 inches thick, instead of 2 feet; and in the aggregate of concrete given, the proportion of sand used is omitted. It is composed of one part of best heavy portland cement, one part of sand, and six parts of broken bricks or other hard materials.

Perhaps you will kindly make these two small corrections in the next "JOURNAL." Everyone would see that 2 inches is a misprint; but perhaps they might not in respect to the concrete.

J. FERGUSON BELL.

Derby, Feb. 10, 1912.

Glasgow Smoke Abatement Exhibition.

SIR,—I can quite understand the propriety of Mr. Griffith, the Secretary of the Society of British Gas Industries, writing to question a statement made in the prospectus of the next Glasgow Exhibition regarding the promised support of his Society; and the Manager will, no doubt, deal with his complaint.

What I wish to refer to is Mr. Griffith's further statement that, "after the experience of the last Smoke Abatement Exhibition held in Glasgow, it is clear that there seems little likelihood of the members of the sections most interested finding it possible to entertain the question of taking part in the exhibition without facing serious financial loss, unless," &c.

This statement clearly infers that the gas apparatus exhibitors at the last exhibition made a serious financial loss. I think I am quite safe in saying that this statement has not the sanction of the majority of the exhibitors, who have assured me that no exhibition held in recent times has given them such satisfactory and immediate results as the last Glasgow Smoke Abatement Exhibition.

Having the figures before me regarding the sales of appliances in Glasgow since the exhibition, and the fact that Glasgow is in the centre of many other populous areas the gas consumers of which were all attracted to the exhibition, I do not see what foundation or authority Mr. Griffith can have for the statement he has made.

If Mr. Griffith and those he represents wish to obtain better terms from the Committee of the Smoke Abatement Exhibition or from the Gas Committee of the Glasgow Corporation, the better plan, in my opinion, would have been to have got into communication with these parties and not have made statements which are sure to do injury to our business and please our competitors.

ALEX. WILSON, Engineer and Manager,
Glasgow Corporation Gas Department.

Glasgow, Feb. 8, 1912.

[There seems to be some misunderstanding over a question of fact; and it is just as well that it should be adjusted as early as possible, in order that the gas section of the proposed exhibition in Glasgow next autumn may not suffer therefrom. Mr. Arthur L. Griffith, the Secretary of the Society of British Gas Industries, appears to infer one thing, while Mr. Wilson has had assurances that the contrary is the case. This is unsatisfactory, as it obviously suggests, as the matter stands, different reports at different times. That, however, is a point discussion of which will not improve the position. The real question for consideration is found in Mr. Griffith's letter. He does not suggest that the sections of the Society chiefly interested will not exhibit in Glasgow next autumn; nor does he suggest that better terms in connection with the exhibition itself are in view. What his letter says is "unless there were some definite prospect of the terms offered by the Glasgow Corporation *to their consumers* for the hire of gas appliances being substantially improved," &c. The prospectus of the exhibition gives some enlightenment upon this very point. It says: "Since the date of the last exhibition, the Corporation of Glasgow have introduced a system of supplying *free of charge* gas-cooking appliances for domestic purposes to all consumers of gas. The adoption by the Gas Committee of a hire-purchase system for the supply of gas-fires and radiators has also met with conspicuous success; and there is every likelihood of the system being extended to other appliances." It will be observed from this that the Corporation of Glasgow have gone a step further than many other gas authorities in one direction; and this seems to offer substantial promise that if in other directions relaxation of terms prove desirable, they will not be long before they take the step. In considering hire terms, too, the reasonable price of gas in the city must not be overlooked. There is an additional consideration that the 1910 exhibition was held on the south side of Glasgow, while the proposed exhibition next autumn is to be in the west-end, and so will reach quite a different class of people who would never think of going to the south side of the city. Our interest in the matter only lies in the direction of assisting to remove any misconception that may exist, and to point to considerations that may have been overlooked.—ED. J.G.L.]

Gas-Fire Construction.

SIR,—It is not my intention to intervene between Mr. Yates and Mr. Thomas Glover; both are well able to take care of themselves. But I do wish, along with many engineers who have the fixing and care of large numbers of gas-fires, that makers would come to some mutual agreement in respect to using an interchangeable radiant or fuel for all fires.

I am quite sure that, by a free exchange of views among makers, the many different patterns now in use might with advantage be very considerably reduced. All makers appear to think it a *sine quâ non* to have their own special pattern of fuel; but really, so far as I can find, there is very little to choose between the many varieties of radiants used—by this I mean actual heat efficiencies.

There are all kinds of shapes and sizes to denote each maker's *sui generis*. But individualism can be carried too far. I fail to see why makers should not meet and agree upon a uniform interchangeable radiant or fuel for gas-fires. All these numerous patterns of fuels are a perfect nuisance, which entail unnecessary waste of time, duplication of stocks, and needless expense.

If makers cannot agree upon a uniform structure, they might at least come to a general agreement in respect to overall dimensions and number of rows of fuel for different sizes of fires; so that there is reasonable interchangeability of fuel for fires by different makers.

I am persuaded that such a course would be a boon to users, and lead to a further extension of the use of gaseous fuel for heating purposes.

It should be remembered that, at present, even the most progressive are only just beginning to enter on the wide region of heating domestic premises by gaseous instead of solid fuel. There is an enormous scope; and it behoves all who help to bring about so desirable a change to make the maintenance of gas-fires as easy and as cheap as possible. Otherwise, unless they are kept in suitable working condition, we shall later hear that they are both inefficient and costly.

It is far from my wish or desire to in any way hinder progress; but great variety of patterns of fuels, which serve no useful purpose, may, instead of being true progress, simply indicate mediocrity.

I may perhaps appear to be somewhat severe on makers of gas-fires who have done much to popularize gas for heating purposes; so I invite their criticism.

Just a word in respect to the flue connections. Leave these amply large, so as to ventilate the rooms as well as carry away the products of combustion. The complaint of stuffiness in rooms, drying of the air, &c., where gas-fires are used is due to want of ventilation.

I find where insets or basket fires are fixed in grates by simply removing the existing grate-bars, and the chimney left open, we seldom have complaints of any kind. I had this brought strikingly home by an example in our own office. The secretary's room, which is heated by a gas-fire, got towards evening very stuffy and unpleasant. The fire was one that did not permit of free ventilation to the chimney. I had it changed for an open grate-pattern fire, with the result that the air in the room is now always pleasant—no dryness or stuffiness being noticeable.

J. FERGUSON BELL.

Derby, Feb. 8, 1912.

SIR,—I have read with interest and profit Messrs. Yates and Glover's articles on modern gas-fires. At the risk of being written-down as a "back number," I would put in a plea for a little less radiant heat and a good deal more low temperature convected heat as the only practical method of heating large rooms.

At present it would seem that makers who are all striving after maximum radiant efficiency are rather playing into the hands of the anthracite stove manufacturers—mostly foreigners, I believe.

It is admitted that radiant heat is the purest form of heat obtainable, the most costly, and I should think the slowest in action in heating-up a room—this last a very important point for the average householder.

My experience is that the ill-effects of high-temperature convection in the old-pattern fires were caused more by faulty canopy flue construction, allowing the products of combustion to escape into the room, than by the simple heating of the air.

There is also the difficulty with the radiant gas-fire user (and there are many in these days), who owns a thermometer, which, of course, is rather a useless instrument for the estimation of radiant heat under ordinary conditions. He has his bed tucked away in a corner out of draughts, and his thermometer hung over the mantlepiece; and he will put you down as an amiable lunatic if you tell him he must pull his bed out into the middle of the room, blacken the bulb of his thermometer, and hang it on the counterpane to get the full effect of "maximum radiation" on the whole. He will tell you that he wants to warm the air a little also, and warm it quickly; and my sympathies are with him to a certain extent, as long as air is diathermanous to radiation and radiant heat will not travel out of the straight lines laid down for it by Nature.

SUPERINTENDENT.

Feb. 7, 1912.

The Fleetwood Urban District Council, at a special meeting held last Tuesday, decided to oppose the local Gas Company's Bill.

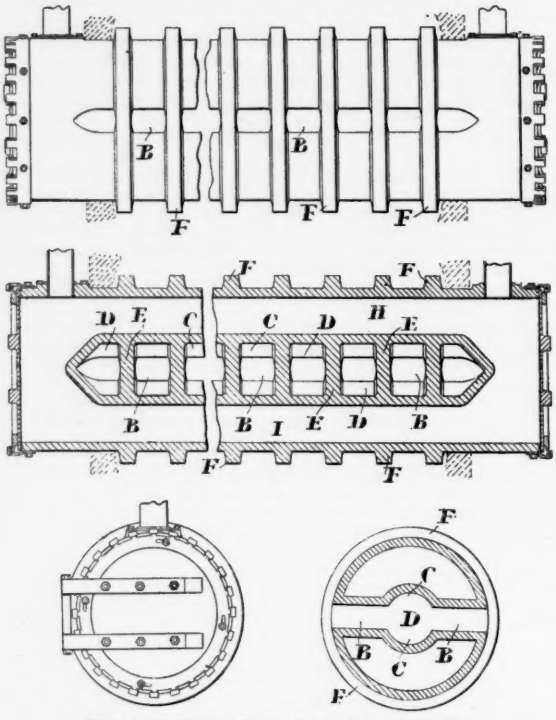
REGISTER OF PATENTS.

Retorts.

MOORE, W. G., of Birmingham.

No. 29,019; Dec. 14, 1910.

This invention has for its object "to provide for a more even and efficient transmission of the heat to the contents of the retort, whereby the distillation or other process carried on therein may be effected more expeditiously and generally in a more satisfactory manner than has heretofore been the case."



Moore's Retorts with Central Heating Chamber.

As shown, the retort is made with transverse flues B having depressions C, which form central chambers D, which together constitute a longitudinal series divided by partitions E. Provided around the retort are a series of ribs F, which are continued and adapted to constitute the partitions or webs E forming the chambers D. The two transverse flues nearest the ends of the retort are (together with their chambers) pointed (as shown); the upper and lower retort chambers H I being in communication with each other at the extremities of the retort.

The retort door may be at one or both ends, or the retort may be permanently closed at one end by webs or walls formed integral with the castings.

Obviously, the patentee remarks, the retort may be installed in any suitable heating chamber or plant, and may be provided with outlets or conduits permitting of the egress of any gases produced during the treatment of the substance contained within the retort.

Manufacture or Treatment of Coke.

ALLEN, E., and GIBSON, R. E., of Liverpool.

No. 29,189; Dec. 15, 1910.

The proposals of the patentees form the subject of an illustrated article on p. 424 of the "JOURNAL" to-day.

Gas and Other Fire-Stoves.

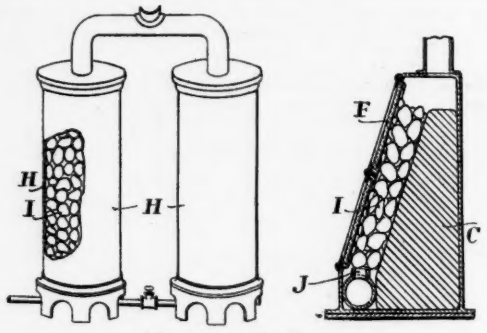
ADAMS, M. J., of Stocksfield-on-Tyne.

No. 7955; March 30, 1911.

This invention relates to "stoves or fire places consuming coal, coke, wood, gas, or other solid, liquid, or gaseous fuel," and proposes to provide them "with heat-radiating walls or surfaces composed of a refractory and semi-transparent or translucent material, arranged in contact with the flames or with the fuel in active combustion." The material employed allows the glow of the flames or fire to be seen; but, "owing to its refractory character, it can be employed in positions in which it is in actual contact with the flames or hot fuel, in which positions it becomes highly heated and provides effective heat-radiating and glowing surfaces."

The two constructions given illustrate the application of the invention to gas-stoves.

The first shows a double-bodied gas-stove comprising bunsen burners, to which gas is supplied through the pipe below. The burners are arranged at the lower end of cylindrical bodies H, made of fused silica, in which lumps I of asbestos or other refractory material are packed. When the burners are lighted, "the cylindrical bodies, where in contact with the flames, are raised to incandescence and glow, while the glow of the asbestos lumps is also visible through the fused silica of which the bodies of the stoves are made."



Adams's Gas-Fire Stoves.

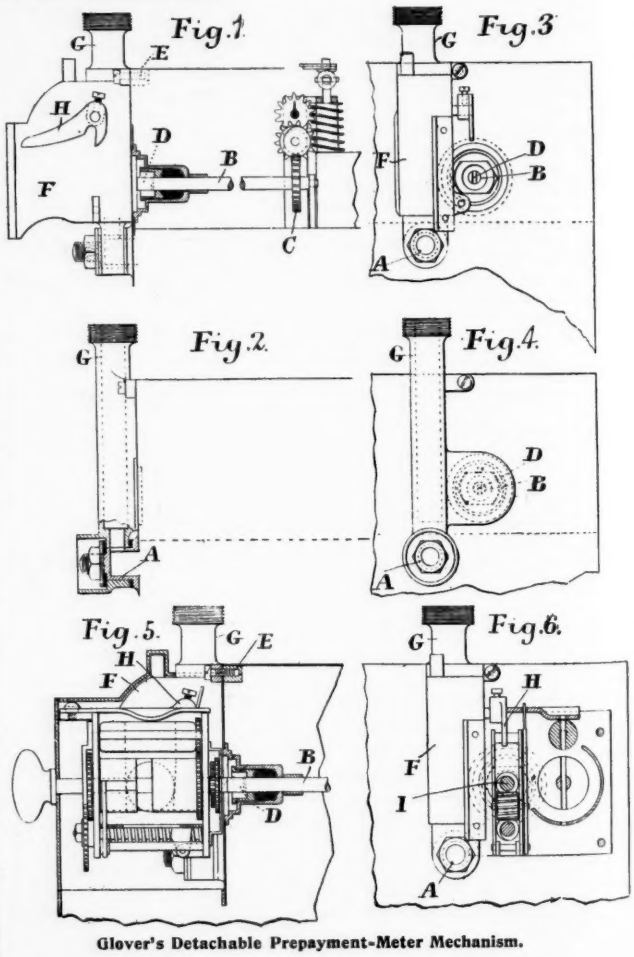
The second construction of stove comprises a casing with fire-clay backing C, asbestos lumps I, and panels F, of fused silica, at the front. The lumps are in actual contact with the panels, on which play flames from the bunsen burner jets J, so that the "panels become highly heated and glow."

Gas-Meters.

GLOVER, THOMAS, of Edmonton.

No. 8136; March 31, 1911.

This invention has for its object to construct a gas-meter and the frame carrying the coin-freed mechanism and a frame used in substitution for the coin-freed mechanism, so that the meter can be used with or without the mechanism—it only being necessary to attach or detach one from the other without altering the construction of the meter or the coin-freed mechanism.



Glover's Detachable Prepayment-Meter Mechanism.

Fig. 1 is a front elevation of a portion of the interior of a gas-meter casing showing part of the mechanism and with a detachable valve-box in place. Fig. 2 shows an outlet or inlet tube attached to a plug projecting from the casing and connecting the outlet or inlet tube with the operating mechanism. Fig. 3 is a side elevation of fig. 1. Fig. 4 is a side elevation of fig. 2. Fig. 5 is a front elevation of a portion of a meter casing similar to fig. 1, and showing the valve-box, the cover, a portion of suitable coin-freed mechanism, and the coin-box. Fig. 6 is a side elevation of fig. 5, with a portion of the coin-freed mechanism and the coin-box removed.

The usual inlet or outlet pipe passing down outside the meter is dispensed with, and in lieu of either there is provided a valve-plug A,

or its equivalent, or it may be a tube projecting from the side of the meter and connecting either the inlet or outlet pipe or passage in the meter to or from the bellows. The meter mechanism is provided with a rod B, carrying a pinion C at one end, gearing with a worm on the shaft connecting the meter mechanism. The free end of the rod is positioned in a stuffing-box secured to the side of the meter casing, and its end is provided with a slot D or other means projecting from, or just inside, the meter casing, but get-at-able from the outside. There is also a hole E in the meter casing, supported by a screw-nut or its equivalent for receiving a screw and for strengthening the casing at that part.

The coin-freed mechanism (figs. 5 and 6) is of the usual construction, and preferably provided with the two worms, as described in patent No. 22,830 of 1894. This mechanism is connected to a frame or casing F containing a valve-box connected with a plug casing; the outlet or inlet G having the usual screw thread. A valve (not shown) is arranged in the valve-box; its arm or axle passing through a stuffing-box into the coin-freed mechanism and carrying a lever H to be operated thereby.

The frame or casing G is attached to the side of the meter by passing the plug casing over and on to the plug A projecting from the side of the meter, and is held thereto by a washer and nut screwed on to the plug; also by a screw passed through a hole in the valve-box casing and into the screw-nut in the meter casing—this being sufficient to hold the casing and coin-freed mechanism to the meter. One of the worms I in the coin-freed mechanism is provided with a blade or other means, which, when the appliance is secured to the meter, engages the slot D in the rod B previously mentioned, so that the meter mechanism and coin-freed mechanism are connected up.

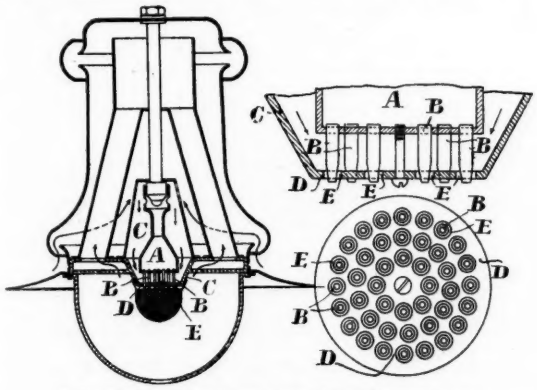
By unscrewing the nut from the plug socket and removing the other screw, the whole appliance can be removed, and a frame or casing similar to that carrying the coin-freed mechanism, but without the valve attached, may be fixed in its place.

Incandescent Gas-Lamps.

AKTIENGESELLSCHAFT FUR SELAS-BELEUCHTUNG, of Berlin.

No. 12,215; May 20, 1911. Date claimed under International Convention, May 25, 1910.

This invention relates particularly to high candle power incandescent gas-lamps, in which the burner-head comprises a plurality of individual small tubes for the outlet of the combustible mixture. The supply of secondary air is improved by the provision of a baffle-plate through which the small tubes pass; the baffle-plate being provided with cylindrical or conical apertures. In this manner, the secondary air supply is uniformly distributed to the small tubes. These small tubes project through the apertures in the baffle-plate, the apertures in which are of such diameter that a more or less annular space is provided between them and the small tubes. The apertures are also preferably of conical form, tapering towards the outlet ends of the small tubes. The supply of air to the small tubes "effects an efficient cooling at the gas outlet openings while at the same time the secondary air is preheated."



Selas High Candle Power Incandescent Gas-Lamp.

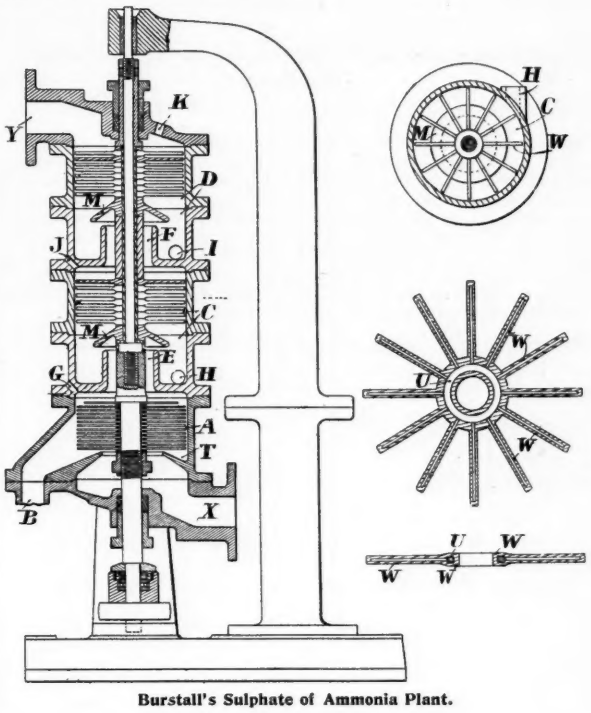
A vertical section of the lamp is shown; also a detail vertical section of the burner-head, and an inverted plan. The burner-head A terminates in a plurality of small tubes B surrounded by a chamber C, having perforations at its upper end by way of which the secondary air is supplied to the lamp. This secondary air enters in the usual manner by openings between the reflector and the outer casing of the lamp. The chamber is closed by a plate D having cylindrical or conical apertures E, through which the tubes B pass. The plate may be as shown, or of dished formation, according to the flame desired, in which case the small tubes are preferably arranged to diverge. Under the influence of the draught in the chimney, secondary air is drawn into the chamber C passing to, and surrounding, the small tubes B, where the pressure is maintained uniform owing to the resistance offered by the baffle-plate D. The secondary air in the passages between the burner-tubes passes through the apertures E, and is supplied to the individual tubes B at the point of combustion—"thus causing a uniform and steady flame."

Production of Sulphate of Ammonia.

BURSTALL, F. W., of Birmingham University.

No. 14,440; June 19, 1911.

The primary features of the machine according to this invention are: A lead chamber through which the gas and hot acid liquid flows; a lead-covered shaft passing through the chamber; durable bearings outside the chamber for the shaft ends and means for driving the shaft; and a series of lead-covered revolving beaters or rotors mounted upon the shaft so as to in greater part fill the chamber and have a beating action upon the gas and acid liquid passing through it. The rotor is preferably built up of a core of durable metal covered with lead; and a further constructional feature of the machine is the building of it around a vertical shaft, so that the base and crown are well protected from the acid liquid.



Burstall's Sulphate of Ammonia Plant.

The preferred form of the self-contained machine is represented in vertical and horizontal section. There are also a sectional plan and an edge section of one of the lead-covered rotors or beaters.

The gas treating chambers A, C, D open to each other in succession at E and F. A central shaft passes through the chambers and has end bearings top and bottom; the latter being provided with a pulley drive. In each chamber is provided a vertical series of rotors, which "revolve with the shaft at considerable, but not very high, speed, so as to beat the gas thoroughly into contact with the liquid" as it passes through the chambers between the inlet X and the outlet Y. The speed of the shaft for a 15-inch diameter rotor is about 600 revolutions per minute.

The part of the casing forming the chamber A is of ordinary metal, as also is the base portion below it through which the gas-inlet is provided. The rotors within this chamber are preferably constructed in accordance with patent No. 10,442 of 1908. The operation of this rotor chamber is to remove from the gas the heavier tars, which find their exit at B, so that the gas passing into the chamber C contains only the lighter in weight tars, or tar oils. The water or liquid entrance to the chamber A is at G.

The part of the casing forming the chambers C and D is of lead, as also are the central sleeve portions providing the openings E and F. These sleeve portions provide liquid collecting troughs, the outlets from which to the exterior of the machine are indicated at H and I. The acid liquor inlet to the chamber C is at J, and the water inlet to the chamber D is at K. Although gas can freely pass from chamber C to chamber D, the liquid operating in the latter chamber cannot flow into the former, neither can the liquid in the chamber C flow into the chamber A, although the gas can freely flow from A to C, as the openings E and F are each efficiently covered by a lead cap M, which revolves always with the shaft and drains all the liquid clear of the openings into the respective troughs, where it is immediately taken off by an outlet of larger area than the inlet to the particular chamber. Where the shaft passes through the chambers C and D, it is lead covered.

The rotors are for all practical purposes lead rotors or beaters, all fixed to the upper portion of the central shaft, over its lead sleeve, by frictionally clamping them between the collared end of the shaft and screw locking nuts. The beaters or rotors in the chamber C substantially fill it, as also do the series in the other chambers.

The gas enters the machine at X and passes upwardly through the chamber A to be washed by the action of the rotors to remove all the heavy tars, dust, &c., which collect in the trough T and pass away from the chamber at B, after which the gas passes up the central opening E, and under the cap M into the sulphuric acid liquor chamber C, wherein, by the beating action of the rotors and the dilute acid liquor, it is thoroughly beaten to form sulphate of ammonia liquor, which quickly flows to the outlet H, without collecting in the trough and without any liquor finding its way into the washing chamber A below. The gas leaves the acid-chamber C by the central opening F and flows under the cap M into the chamber D, where it is again washed by water and the action of the rotor series, after which it passes away, without containing any acid at all, by way of the outlet Y. Here, again, the washing liquid entering at K flows into the trough below, and quickly leaves it, without collecting, by the outlet I, so that none of the liquor flows into the acid-chamber below.

Thus is provided, the patentee claims, a self-contained machine capable of treating gas direct from the retort, coke-oven, or the like, to,

firstly, remove the heavy tars, secondly, form sulphate of ammonia, and, thirdly, again wash the gas of all traces of acid—it being understood that the gas passes from the machine at a temperature of about 85° to 90° C., and that all liquids enter at about this temperature.

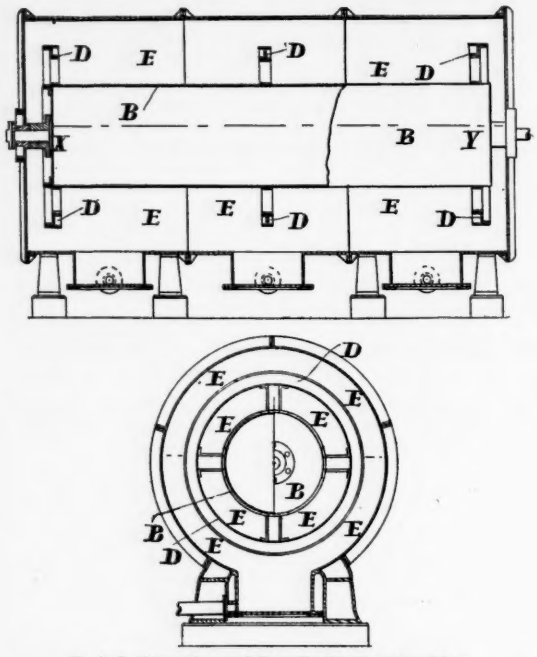
Each rotor is built up of a metal ring U and a number of radiating wires, all covered with a lead exterior W, the ring and wires efficiently forming a core to the rotor for durability. Each rotor is formed so as to provide a durable metal core lead-covered.

Supporting Device in Horizontal Rotary Scrubber-Washers.

R. & J. Dempster, Limited, and Beard, G. F. H., of Manchester.

No. 15,856; July 8, 1911.

The object of this invention is to combine with a scrubber-washer a buoyant shaft or drum in place of (or equivalent to) the centre shaft ordinarily employed. The shaft, when immersed in the liquid within the washer, is capable of being revolved in any convenient manner. Mounted upon the shaft are the usual surfaces, brushes, or screens to be wetted in passing through the washer liquid as the drum revolves. To facilitate this, the drum may be provided with trunnions or end shafts mounted in bearings at the ends of the washer, and passing through same, so as to be operated by outside gearing.



R. & J. Dempster and Beard's Washer-Scrubber.

The illustration shows a longitudinal elevation (partly in section) of a portion of a scrubber-washer provided with a buoyant shaft according to one form of the invention, and an end view, also partly in section.

The drum B is assumed to be partly immersed in the liquid within the washer, the level of which liquid is indicated at X Y. It may contain air or gas. D are supports for the members provided for the purpose of carrying the screens, brushes, or the like (not shown) normally situated in the space E of the washer.

It may be, the patentees point out, that the ends of the drum itself rest in bearings; and it is obvious that a portion only of the weight of the drum need be supported by the liquid. On the other hand, the whole of the weight may be so supported; the end bearings acting as guides merely for facilitating the even rotation of the drum.

As a variation, the drum may be provided in sections with ordinary connecting shafts between—some, or all, of which sections support the standards, such as D, or some portion of them.

Incandescent Mantles.

Mathys, A. W.; a communication from Front G.m.b.H., of Berlin.

No. 17,492; Aug. 1, 1911.

This invention relates to mantles for incandescent lighting, of the type in which a plurality of reinforcing strands are arranged in the fabric of the mantle so as to render it durable, and to a process for the treatment of mantles whereby "the liability of the mantles to break is greatly lessened."

It has heretofore been proposed, the patentees remark, to treat the reinforcing strands with beryllium nitrate and didymium nitrate, for the purpose of hardening them; the salts being introduced into the solution employed for rendering the strands luminous when subjected to heat. According to the present invention, the usual fabric is reinforced by thickened horizontal and vertical strands; and the reinforced fabric in this form (or shaped to form the mantle) is impregnated with a solution containing the following ingredients:—

80 parts of thorium nitrate—70 per cent. oxide.
4 parts of nitrate of zirconium.
1 part of oxalic acid.
5 parts of nitrate of beryllium.
0·5 part of nitrate of cerium.
9·5 parts of nitrate of yttrium.

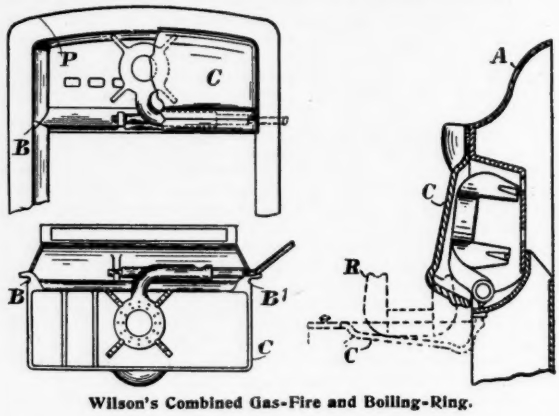
Mantles prepared according to this prescription are said to be "very considerably strengthened, and breakage can only be effected by a violent or direct mechanical influence."

Gas-Fires and Gas-Stoves.

Wilson, H., of Armley, near Leeds.

No. 18,638; Aug. 18, 1911.

This invention has for its object the combination of a gas-fire with a gas-ring for boiling in such a manner that the boiling-ring can be readily enclosed out of sight in the gas-fire when not required.



Wilson's Combined Gas-Fire and Boiling-Ring.

The illustration shows an elevation of the stove with a portion of the cover removed; also a sectional plan with the boiling-ring in position for use. Further, there is a sectional side view showing the stove or ring in the closed or "not in use" position.

The patentee forms in a suitable position on the upper framework or casting A, a recess or pocket P, to accommodate a burner-ring R. Mounted in bearings B B^1 is a cover C, which will shut the burner or ring out of sight when it is not in use—being practically the usual canopy with stoves of this description, but movable instead of fixed. Therefore the appearance of the stove as a whole is not altered. This door is also adapted to act as a support for the burner-ring when it is in use, and is arranged to serve also as a well or trough. Thus, should the contents of the utensil upon the burner-ring boil over, the trough of the cover C will protect the grate and prevent it "becoming unsightly."

APPLICATIONS FOR LETTERS PATENT.

2263.—Candy, F. & F. P., "Purification of water." Jan. 29.
2268.—Bowley, J. W., "Measuring flow of liquids." Jan. 29.
2277.—Booth, J. & J. R., "Packing mantles." Jan. 29.
2278.—Harker, L. H., "Inverted burners." Jan. 29.
2326.—O'Connell, P. B., "Gas-engines." Jan. 29.
2333.—Byrne, J. F., Lawrence, J., and Howes and Burley, Ltd, "Acetylene generators." Jan. 29.
2358.—Le Pin, R., "Controlling gas supply." Jan. 29.
2411.—Spicer, M., "Portable gas-fittings." Jan. 30.
2412.—Spicer, M., "Operating gas-taps from a distance." Jan. 30.
2418.—Scott, A. C., "Engines on the Otto cycle." Jan. 30.
2501.—Sanford, T., "Gas and oil producer." Jan. 31.
2523.—Braithwaite, C. C., "Controlling water supply." Jan. 31.
2566.—Beville, W. J., "Illuminated gas-signs." Jan. 31.
2572.—Davis, G. K., "Distillation apparatus." Jan. 31.
2590.—Forsyth, G., "Acetylene-generators." A communication from C. F. Anderson. Feb. 1.
2607.—Thompson, W. E., "Reducing the light on an incandescent burner." Feb. 1.
2608.—Liversedge, A. J., and Davidson, W. B., "Apparatus for washing gases, applicable also for distilling purposes." Feb. 1.
2617.—Watkins, W. J., and Oxine Gas Manufacturing Company, "Manufacturing carburetted gas." Feb. 1.
2706.—Sutton, C. J., and Brennan, M., "Incandescent burners." Feb. 2.
2767.—Walker, J. S., T. A., & E. R., "Valves for compressors." Feb. 2.
2786.—Ames, R., "Pipe-joint." Feb. 3.
2796.—Guy, F. H., "Supplying a mixture of gas and air." Feb. 3.
2832.—Ames, R., "Joint for pipes." Feb. 3.
2851.—Sawyer, R., "Thermostatic valves." Feb. 3.
2857.—Brougham, F. J., "Separation of tar and ammoinum chloride contained in gases." A communication from Solvay et Cie." Feb. 3.
2875.—Glover, J. W., "Leak detector." Feb. 3.
2876.—Lochner, R., "Crushing coke, &c." Feb. 3.

South Staffordshire Mond Gas Power and Heating Company.—At the eleventh ordinary meeting of this Company next Monday, the Directors will report that during the year ended the 31st of December last the number of customers increased from 111 to 128, and the number supplied from 102 to 123. The profit on the revenue account is £8856 and in 1910 it was £4429; the difference in the two years being £4427. After adding the amount brought forward (£358) and bank interest (£145), and deducting interest on the debenture stock for the year (£4426), there is a net profit of £4933, out of which it is proposed to pay a dividend at the rate of 2s. per share (less tax). This will absorb £3305, and leave a balance of £1628 to be carried forward. The Directors consider this progress satisfactory.

THE GASLIGHT AND COKE COMPANY.

The Two Hundredth Half-Yearly Ordinary General Meeting of the Proprietors was held on Friday, at the Chief Office, Horseferry Road, Westminster—Mr. Ulick John Burke (the Deputy-Governor) in the chair.

The Absence of the Governor.

The Deputy-Governor: Ladies and Gentlemen, before we go to the business of the meeting, there is one matter which so nearly concerns us all that I should like to say a few words about it. I refer to the absence of the Governor on this occasion. I have received a note from him, in which he begs me kindly to tell you how deeply he feels and regrets not meeting you as usual. In his letter, he says: "You may safely promise for the current half year that we shall not only pay an increased dividend, but that we shall earn it. I am feeling quite strong to-day, and almost tempted to break bounds." What Mr. Woodall has done for this great undertaking, what he has done for the advancing and always advancing science of gas making, what he has done for the spread of all the comforts of light and warmth in this immense district of ours, and, finally, what he has done towards the solution of the complex question of labour, is common knowledge; and the report and accounts submitted to-day speak for themselves. But I must say this further, that it is not perhaps common knowledge what we, his colleagues on this side of the table, know—that Mr. Woodall has given to this Company a masterly knowledge of absolutely every detail from the administration of the Board-room affairs down to almost, I might say, the last nut in the gasholder. He knows everything connected with the affairs of this Company. But the large amount of good which he has done for the Company means, of course, very, very strenuous work; and I need hardly say that any machine working at high-pressure, whether a human or a mechanical one, must have rest at some time. Yesterday, he was with us; and we then urged him to avoid the strain of attending this meeting. I must say, however, that nothing would have surprised me less than to have seen him present to-day. As you know, you may take a horse to water, but you cannot make him drink; and it is exceedingly difficult to keep the Governor away from business. I sincerely hope that a rest will restore him to his former strength, and enable him to again preside over your affairs. [Applause.] I will now ask the Secretary to read the notice convening the meeting.

The Secretary (Mr. Henry Rayner) having read the notice, the seal of the Company was affixed to the register of holders of capital stocks.

The Deputy-Governor: I am glad to say that Mr. Woodall has been able to write out his speech; and, as I think it is very desirable that you should have it stated to you in his own words, I will ask Mr. Watson, our General Manager, to read it.

The report and accounts [given in the "Journal" last week] having been taken as read,

The Governor's Speech.

Mr. D. Milne Watson read the Governor's written speech, as follows: The report we set before you to-day is, in our opinion, again a good one.

Increased Dividend and Co-partnership Bonus.

In face of what has become our usual reduction in the price of gas—a reduction which meant in the past half year a diminished profit of £50,000—we have paid our way, and, as compared with the same date last year, increased our dividend and the co-partners' bonus. At the same time, the revenue balance carried forward is £101,000 more than at Christmas, 1910, of which additional sum £27,000 was earned in the half year under review. Beyond this, we have added £20,000 to the special purposes fund, provided £15,000 for redemption, and have written-down the book value of our investments by £8917. It is true that the balance of revenue account is £40,000 less than in the corresponding half year, but, as against an increased sale then of 3 per cent., we are now dealing with a loss of nearly 1 per cent. The average temperatures for the two half years were 52·6°, against 56·9°. This difference is quite sufficient to account for the loss of output. An illustration of the influence of temperature is furnished by our experience in the current year. Up to Jan. 23, the gas sold was less by 65 million cubic feet than at the same date last year. In the intervening winter days to Feb. 7, this deficiency has been wiped out, and now we are 27 millions to the good.

Capital Expenditure—Sale of Surplus Land.

From the accounts before you, it will be seen that there has been an expenditure on capital account of £108,821. I grudge the spending of any capital when there is no increase of business to set against it. While, however, we have to lay mains, connect services, and provide meters and stoves for many thousands of additional consumers annually, the capital must grow. The total for the half year is made up as follows: Building and machinery in extension of works, £7044; new and additional mains and service-pipes, £38,387; new and additional meters and stoves, £63,390—total, £108,821. Against this, there is a credit of £87,833—£28,580 arising from the sale of surplus land, £4952 for depreciation of plant, and £54,302 for depreciation of meters and stoves. The net additional expenditure on capital account is thus some £21,000. The land sold was the site of the Silvertown station. I am glad to say at all the stations machinery and plant have been maintained in perfect condition.

New Water-gas Plant.

Of the reconstructed carburetted water-gas plant at Beckton, one of the three large units in process of erection, each of which will be equal to the production of 2½ million cubic feet daily, will be in work during the current month. The remainder will, I hope, be in use about the end of April.

The Revenue Account—Bye-products.

The figures of the revenue account are satisfactory, except so far as they are affected by the reduced output of gas. For five consecutive half years we have had an increase in business; and, for the reasons I have given, this present falling-away is not surprising. Loss of revenue on this account amounts to £15,000. In addition to this sum, the reduction in the price of gas cost, as I have already said, £50,000; making a total decrease of £65,000. On the other hand, rental for meters, stoves, and fittings yielded an increase of £14,000. We have done well with all our bye-products. Coke brought an increase of £10,000, breeze £3000, tar and its products £12,000, ammoniacal liquor £6000—due, not to increased quantities sold, but to higher prices. The total of this is £31,000.

Expenditure Items—Increase in Wages, &c.

On the expenditure side of the sheet, we find that coal has cost us £20,000 less; oil, practically the same figure; and coke and breeze used for carburetted water gas, owing to the advance in market prices, £2000 more. The result being that the net coal cost us £49,000 less than in the corresponding half of the previous year. The working of the Company during the half year has been on the whole satisfactory. Carbonizing wages have gone up by £9000. This is due largely to the fact that the Directors felt that the time had come when an advance in wages should be given to certain classes of employees; and an additional week's holiday pay has been given to all men who have been for three years or over in the service of the Company. This has been very highly appreciated, and will tend to confirm and strengthen the feelings of attachment and loyalty to the Company, of which the Directors have received recently many welcome evidences. The quantity of gas made per ton of coal has slightly decreased—viz., from 11,900 to 11,800 cubic feet per ton. This is due chiefly to experimental working intended to determine how far a high yield of gas from the coal harmonizes with the obtaining of the fullest value in bye-products. Careful investigation is proceeding. Improved purification has cost some £2000 more than last year; and co-partnership, I am glad to say, a like amount.

Distribution Matters—Gratuitous Services.

The net increased expenditure on distribution has been £6000, inclusive of £2500 additional for depreciation on meters and stoves. The outlay in this department is a growing one—largely owing to the altered policy of the Company in its relation with consumers. Services for which a charge used to be made are rendered now gratuitously; and although the expense so incurred may slightly affect the price of gas, we feel, on the whole, the policy is a wise one. At the same time, this increase is a matter which is having special attention.

Increase in the Number of Consumers and Stoves.

There has been an increase during the six months of 14,665 consumers, and of 32,772 in the number of stoves let on hire or sold.

The Training of Fitters.

I am glad to say that our scheme for the training of fitters is working very satisfactorily. We have now 83 lads undergoing instruction; the last batch having started work this month. The first group—those who were first taken on as apprentices—have completed three out of their four years' training; and it is reported to me that they are, as a rule, intelligent fellows, and proving to be assistants to the fitters with whom they are working far superior to those previously chosen haphazard and without suitable training.

Public Lighting.

With regard to the other items on the expenditure side, public lighting shows an increase of £3000, due to more demonstration work being done by the Company for local authorities. The effect of this co-operation is seen in the vastly improved lighting of a large part of the Metropolis, and in the general acceptance of the proposition that in appearance, efficiency, and cost, gas holds the premier place. I am pleased to report that during the half year we have settled public lighting contracts for a number of years with the following authorities: Hendon Urban District Council, Wanstead Urban District Council, Holborn Borough Council, and the City Corporation.

Bad Debts—Insurance Fund—Investment Depreciation.

Bad debts show a satisfactory reduction from £8000 to £6000. The Company's insurance fund has been merged, under the provisions of the last Act of Parliament, in the special purposes fund—a fund which has found a place in many recent Acts of Parliament, and which not only covers all the purposes for which money invested in the late insurance fund was available, but also makes such money available for the expense incurred in the removal and replacement of plant—an extension of power which it is important to have had clearly defined. We have therefore carried £20,000 to this fund, as has been done for some time past, to the insurance fund We have also taken the opportunity of writing-down the cost of investments in Consols and 3 per cent. India stock, in which the insurance fund is invested—in the case of Consols, to 80 per cent., and in that of the 3 per cent. India stock, to 85 per cent. This has cost the Company nearly £9000 in all.

The Redemption Fund.

There is also an extra contribution of £5000 to the redemption fund. As the shareholders know, this fund was introduced by the Company's Act of 1903; and it works in such a way that every third penny taken off the price of gas in respect of which the Company distribute an extra dividend makes it necessary for a further sum of £5000 per half year to be carried to capital redemption. As explained at the general meeting in August last, this contribution happens to occur when the price of gas is reduced from 2s. 8d. to 2s. 7d. per 1000 cubic feet, which was the case in January, 1911. The Company have therefore to contribute the extra £5000 for the past half year. I may say, in passing, that, were it not for this contribution to the redemption fund, the increase in dividend for the half year would be at the rate of 2s. 8d. per cent. per annum, instead of 1s. 4d. as it is.

Financial Result of the Half Year.

The financial result of the half year is that, after providing for fixed charges and making the contributions named to the redemption and

special purposes funds, there remains a profit balance of £409,865 2s. 11d. The amount brought forward from the previous half year was £699,350 1s. 7d. There is therefore a total available balance of £1,109,215 4s. 6d., out of which the Directors recommend the payment of a dividend on the ordinary stock at the rate of £4 14s. 8d. per cent. per annum, which will absorb £382,467 10s. 8d.; and leave £726,747 13s. 10d. to be carried forward to the credit of the current half year. I stated in February last, when the price of gas was reduced to 2s. 7d. per 1000 cubic feet, that we would not have to call upon our reserves to make up dividends. I hardly hoped that we should be able to pay dividends and add £100,000 to the carry-forward.

THE BARKING AND CHIGWELL WORKS.

The amalgamation with the Barking and Chigwell Companies took place on Jan. 1. We have now closed the works of both these Companies; and the gas required on their districts is being made at Beckton, and distributed, by means of high-pressure mains, from that station. The Company hope in due course to reap the advantage of this large extension of their area; but it must be remembered that at present the new district is largely represented by green fields, and the shareholders must not look for any immediate large increase in business on account of these amalgamations. So much for the actual position of the Company as shown by the accounts of the past half year.

FUTURE PROSPECTS—REDUCTION IN THE PRICE OF GAS.

We must now face the future, which holds for us, as for all other industrial undertakings, much cause for anxiety. Part of this solicitude is of our own creation, arising directly, as it does, from the unanimous decision of the Court that the promised further reduction in the price of gas by another penny, to 2s. 6d. per 1000 cubic feet, should take effect as from Christmas. This is, in the circumstances, perhaps a bold step, and it was not decided upon without a careful review of the situation both within and without.

THE COAL OUTLOOK.

Against the proposition to sacrifice the £130,000 a year represented by this remission might be opposed the certainty of dearer coal, and the possibility of graver results from discontent among coal miners—a prospective danger against which already some extra expenses in preparation for meeting a difficulty of supply have had to be incurred. In addition, the falling off of gas consumption mentioned in the report as due to climatic influences, could not be truthfully described as encouraging. Yet, after all, we agreed that the policy of reduction would prove to be the safe one, as it was plainly the bold and the right one. It is justified by the strength of our reserves, always assuming there will be no interruption in our supply of coal. If so great an injury to the commonwealth as a stoppage of the national coal output should be perpetrated, our undertaking could bear it better and longer than most manufacturing industries. You are aware that we are not wholly dependent upon coal for the manufacture of the gas we supply. From a ton of coke we produce five times the quantity of gas obtainable from the same weight of coal; and this gas, when suitably enriched with oil, serves equally well every purpose of our consumers. Moreover, by more economical working, we have been, and are, able to save large quantities of coal. Thus we occupy an exceedingly strong position both materially and financially. Nevertheless, we do most sincerely hope and trust that wise counsels may prevail with all parties in the coal-mining industry, and that its internecine troubles and difficulties, which are probably more complicated and serious than outsiders can realize, may in good time be composed and settled without the lamentable episode of a general strike or lock-out. For, whatever happens, there must be arbitration at last; and the only vital question is whether this conclusion shall be accepted first, in cool blood and without rancour, or after a period of brutal and devastating waste and the unchaining of evil passions which characterize war. For a general strike is war upon society, the cost and suffering of which fall heaviest on non-combatants and those who have no part in the quarrel, and nothing to gain by the sorry triumph of either side. Our national coal trade once stopped would never be restored upon so good a footing. Thousands of people thrown out of employment would lose their means of livelihood, and no legislation could help them. In all industries and trades there are establishments and employees just keeping their heads above water and no more. A general colliers' strike would submerge these beyond possibility of recovery. The cost of all home-manufactured articles would rise; imported substitutes would flow in to take their place, and themselves be dearer; and there would be no earned money to pay for them. A vast volume of trade would be driven from the country never to return. We do not therefore—we cannot—believe in the possibility of a general colliers' strike and lock-out of any long duration; and consequently we have backed our judgment, or rather our faith, in the common sense of our countrymen, by persevering in that policy of cheapening gas whenever possible which we have now pursued for five successive years. Whatever happens, we shall feel that we have been true to the public and to our own convictions. Should the worst happen, and we have for a time to retrace our steps, we shall do so without shame and in company with practically every manufacturing industry in the country. I rejoice that it is my privilege to make this announcement now, in the centenary year of the Company, of the cheapest gas we have ever sold—for only once before, for a brief period, has the price been down to half-a-crown. We mean, by every resource at our command, to keep it there, or lower (for we are not at the end of our economies), if exterior conditions will only prove reasonably favourable. Should a general strike take place, we may, I think, reasonably hope that the Government and Parliament will reimpose for a time a duty on exported coal. By this means, the difficulty of restarting factories and workshops caused by the exhaustion of stocks of fuel would be to some extent lightened.

THE COMPANY'S EMPLOYEES AND NATIONAL INSURANCE.

The National Insurance Act has come into being; and, in view of the expressed reluctance of the members of the Company's own Workmen's Provident Societies to accept the Government scheme in substitution for the advantages they actually enjoy, I ought to explain the view we take, and state the nature of the steps we have in contemplation to satisfy our own society men. I can freely declare that we entertain no feelings of hostility to the Act. On the contrary, we admire the principle, and we are agreed in welcoming it, and prepared to assist in making the best of it. At the same time, it is but natural that we should feel a little proud of the fact that, in the estimation of our own men, we had "gone better" than the great Government measure. The first point of difference between the two schemes is that, whereas our societies do not include all our workpeople, the new "approved" society which must be framed on the lines laid down by the Act will do so. This will not be to the advantage of the present society members. We propose, therefore, to set up a provisional supplementary insurance society for them, to be supported by them with weekly payments representing the difference between their present contributions and those required under the Act, and further aided by the Company, which will conserve the actual benefits, while they participate in such additional advantages as the Act confers. This will be a temporary expedient which will work itself out with the existing lives; and all the rest will come under the Act pure and simple. This arrangement may, on the face of it, cost the Company an additional £7000 a year; but we cannot grudge this expense, especially if it is regarded as the price of extending the benefits of insurance to the whole of our workpeople. We trust also that our co-partners will acquiesce heartily in the necessary determination of our very successful and highly appreciated societies of picked lives. It is evident that there could not continue to be two grades of insured persons in the service. Those who might feel aggrieved at losing an exceptional advantage will remember that "we are all one of another."

THE COMPANY'S CENTENARY.

You have been reminded in the report that the Company's Charter is now one hundred years old—its date being April, 1812; and I hope it may be my good fortune to occupy this place at our next meeting, when I shall have a few words to say with regard to the interesting story of the Company. In the meantime, we shall try to commemorate the aniversary in a manner that will impress it upon the memories of the employees.

A RETIREMENT, A DEATH, AND STAFF CHANGES.

This month, the Company are losing one of the oldest and most valued of the members of their staff. Mr. John Wilton entered our service in the year 1864, and has consequently been with us for 47 years. He has been Engineer-in-Charge of the works at Bow Common for 27 years. I am sure all his colleagues will agree with me that no man in the Company's service is regarded with more sincere respect and goodwill, and, by those who know him best, affection also. In his retirement, we all wish him long life and health to enjoy the rest he has well earned. I am sorry to close with a note of sadness. On the 17th of January, without even a day's warning, Mr. Harold Iago, the Engineer of the Shoreditch and St. Pancras stations, was called away by death. Up to the last hour of his life he was actively employed; and we had no more efficient and successful officer in the Company. He was not only a good officer, but a good man—amiable, modest, and lovable. We all deeply deplore his loss. The place of Mr. Wilton will be filled by Mr. Reidie, who was Engineer of the Barking Company recently taken over by us, and who brings with him a very good repute. The position of Engineer of the Shoreditch station will be filled by Mr. Solomon, the present Chief Assistant-Engineer at the Beckton station. We welcome both of them to their new positions, and we wish them increasing success.

MOTION FOR THE ADOPTION OF THE REPORT AND ACCOUNTS.

The DEPUTY-GOVERNOR: I have now the pleasure of moving—"That this meeting do agree with and confirm the report of the Directors and the Auditors' report and statement of the accounts of the Company as transmitted to the proprietors on the 1st inst." But, before putting the resolution to the meeting, I shall be happy to hear any remarks which proprietors may wish to make, and to endeavour to answer any questions asked.

Mr. JOHN MILES seconded the motion.

REMARKS BY SHAREHOLDERS.

Mr. E. KIMBER said, to his mind, the finest point in the Governor's speech was that in which the hope was held out of a carburetted water-gas plant being erected. Twenty years ago, the Company consumed about 2,000,000 gallons of oil; but last half year they used 6,900,000 gallons, or about 13,000,000 gallons for the year. The cost of oil, according to the accounts, was about £1 11s. 3d. per ton; and after giving credit for residuals, coal apparently cost net 2s. per ton, which worked out at 2d. per 1000 cubic feet of gas, and oil produced 1,111,000 cubic feet of gas. It was all very well for strikers and those leading them to say that if gas companies were going to use oil they would not handle it; but it must not be forgotten that there was such a thing as unloading by machinery. It was said in Nottingham that if foreign coal was imported the men would refuse to handle it; but since then several contracts had been made in this country for the Mediterranean trade, which was about 8 million tons of coal. In the event of a strike, half of this trade would leave the country; and he should not be at all surprised if by the end of the year nearly the whole of the Mediterranean trade had gone. This was a very serious thing for the strikers to contemplate. They were their own enemies; and it was a very extraordinary thing that they should not take into consideration the possible effect of what they were doing. It was all very well for them to say that they wanted a minimum weekly wage of 30s.; but the question was, What would be the result if they had it? The coalowners said they could not afford it. They said they would arrange such a rate of pay as that the minimum would be about 30s. a week; but they went on to say they would have a fair day's work for a fair day's wage, and that the wage would come not to 30s., but to considerably more, per week. He knew of no cause for the dissatisfaction and discontent which at present prevailed. On the other hand, he agreed with what had been said by the Governor—that the gas companies should do all they could to improve and economize the means of gas manufacture. The Governor's speech was of national importance—not only to them, but to every gas company in the country. The Gaslight and Coke Company stood on a more solid basis than any other gas company; and it had shown the world, and strikers in particular, that it was not

altogether dependent upon coal for the manufacture of gas. In his opinion, the Governor had not only got an increased output of gas, but he had put himself at the head of the Trinidad Oil Company; and, in the prospectus of that Company, it was stated that they were laying down a refining-tank for 150,000 tons of oil per annum. Now 100,000 tons of oil would be sufficient for the whole of the gas companies in the Metropolis; and not only could this be done by one company, but by three or four companies, as there appeared to be an inexhaustible supply of oil in America. At the present moment, there were on the west coast several American owners of oil-fields ready to form oil companies immediately the Panama Canal was finished; and they would then be able to bring thousands of tons of oil through the canal to all over Europe.

Mr. F. W. Bruce said that, with all due respect to the Board, he thought it was an injudicious policy to reduce the price of gas in view of the unrest in the coal industry, and when £42,000 less this half year was brought into the account. He noticed that £9000 had been written off "investments," but that only two were named—viz., Consols and India Threes; and he asked whether any other stock had been written-down. He also noticed that though two stocks had been written-down, there was still a difference of about 3 per cent. in Consols and 5 per cent. in India stock. He thought the Board should at the termination of each half year write-down the securities to their proper market value. He further noticed that the amount invested was about £700,000; and he hoped that in future balance-sheets the Board would enumerate the various holdings representing this large sum.

Mr. G. W. Preston said that in Account No. 3 the total expenditure up to Dec. 31 was £14,686,306; and credit was taken for the sale of surplus lands, £28,580; for depreciation of plant, £4952; and depreciation of meters and stoves, £54,301. But, three lines lower down, there was deducted "the amount of capital redeemed under the Act of 1903," £139,725. He asked whether the £14,598,472 represented the actual expenditure up to date, and what provision had been made for depreciation of the undertaking generally, as distinguished from the depreciation of plant and meters. It appeared to him that no depreciation beyond the amount of the capital redeemed had been made in respect of this gigantic undertaking. In Account No. 8, there was shown a balance on June 30, 1911, of £58,823. In the special purposes fund account for the half year ending Dec. 31, the balance to the credit of the insurance account was £213,874, and in No. 10 Account the depreciation fund balance was £77,152 The questions he asked with reference to these figures were: What was the nature of the investments and the percentage of income derived from the investments? With regard to Account No. 13, a point of great importance was contained in the last column but one—viz., unaccounted-for gas, 769,505,000 cubic feet. There had been a considerable reduction on this during the last half year; but it occurred to him that, unless there was some satisfactory explanation of this loss of 770 million cubic feet (representing, at 2s. per 1000 cubic feet, £77,000), it was a very serious matter indeed. He asked if it was an estimate only, or an approximate estimate approaching to the actual leakage; and, if so, what steps had been taken to prevent this leakage.

Mr. F. W. Bruce inquired what funds were included in the securities mentioned in the balance-sheet, and whether any of the funds were hypothecated to specific purposes.

Reply of the Deputy-Governor.

The Deputy-Governor: If there are no other questions to be asked, I, first of all, thank Mr. Kimber for his interesting speech. I need hardly say that the question of oil does enter very much into the possibilities of this great concern; and it is gratifying to hear from him the statement about unloading. In reply to the speaker who deprecates our lowering the price of gas, I cannot tell you how very, very serious and close our examination was into the case before we decided upon such a step as this. I need not, however, tell the proprietors, because I am sure they will all agree with me that one of the leading acts of policy of any gas company, having regard to the competition with electricity, is to lower the price of gas as much as possible. I think this is a prudent course to adopt. The Directors have thought it out, and they have come to the conclusion that a reduction in the price is desirable. With regard to stating the market value of the investments, there would be very great difficulty in adopting the suggestion of the proprietor every half year, because of the constant fluctuations in the prices of the securities. People who can read the market must know why we do as we do. As to our investments, we have the reserve fund invested in India Threes, and the special purposes fund is in India Threes and Consols. The depreciation fund forms part of the floating capital—it is in our business, it is not invested. Then, as to the unaccounted-for gas, this is a very difficult matter which every gas company has to meet. I noticed that the proprietor did not ask the percentage, which is really the guide. You must remember that the manufacture and distribution of gas varies enormously as time goes on. Now and then there is an increase in the unaccounted-for gas; but it does not necessarily mean leakage. This is a popular delusion. I could not give you the exact reason for a decrease or an increase, because it is a very complicated question; but it engages our attention very closely.

A Proprietor inquired which of the two Companies—the Barking or the Gaslight and Coke—would pay the last Barking dividend.

The Deputy-Governor: This Company will pay it.

The resolution was put to the meeting, and carried unanimously.

The Dividend Resolution.

The Deputy-Governor: I will ask the Secretary to read the dividend resolution.

The Secretary then read the Directors' minute of Jan. 19 as to dividend, as follows:

Resolved—That it be recommended to the half-yearly ordinary general meeting of proprietors to be held on the 9th prox.—

(1) That the sum of £15,000 be set aside out of the divisible profits of the Company for the half year ending on the 31st day of December last towards the redemption fund, in accordance with the provisions of the Company's Act of 1903, and

(2) That a dividend as follows for such half year be declared—viz.:

On the 4 per cent. consolidated preference stock, at the rate of £4 per cent. per annum.

On the convertible 5 per cent. preference stock, at the rate of £5 per cent. per annum.

On the 3½ per cent. maximum stock, at the rate of £3 10s. per cent. per annum.

On the ordinary stock, at the rate of £4 14s. 8d. per cent. per annum.

Subject to deduction of income-tax.

The Deputy-Governor: I move this resolution.

Mr. John Miles having seconded,

The resolution was put to the meeting, and carried unanimously.

Re-election of Directors and Auditors.

The Deputy-Governor: The next business is the re-election of two Directors who retire by rotation. One is Mr. Corbet Woodall, the Governor; and it is hardly necessary for me to say any more than I have said already. The Governor is an asset of the very greatest value to this Company. We all hope to see him here again, as I am sure we shall do. I beg to move the re-election of Mr. Corbet Woodall.

Mr. John Miles: I have great pleasure in seconding that.

The resolution was carried unanimously.

The Deputy-Governor: I next propose the re-election of Mr. James Douglas Walker, K.C. He has been a Director for some years; and I am sure we all value him as an esteemed colleague.

Mr. John Miles: I have great pleasure in seconding that.

The resolution was carried unanimously.

The retiring Auditors—Messrs. John Allen Stoneham and John James Walker—were unanimously re-appointed Auditors.

Disposal of Surplus Lands.

The Deputy-Governor, in proposing a resolution authorizing the disposal of certain portions of property not now required for the purposes of the undertaking, said: I have now to submit a resolution empowering the Directors to dispose of certain lands, situate at Beckton and Bromley respectively. I reported to you a year ago that the Port of London Authority contemplated a large extension of their dock accommodation; and the execution of their scheme involves the acquisition (partly by purchase and partly by exchange) of a portion of the Beckton estate. In agreeing to sell, subject to your confirmation, the Directors were actuated largely by a desire to co-operate in the carrying out of a great public improvement, likely to provide work for a considerable body of men in a part of London where unemployment has, I fear, been only too prevalent of late. Incidentally the scheme should benefit this Company by bringing a large number of gas consuming residents into the district. The resolution with regard to Bromley is necessitated by the decision of the Directors to develop as a building estate a portion of the Company's vacant land there, for which, until lately, there has been little or no demand. The proposal is either to grant long building leases or to sell outright, as circumstances may dictate. Here, again, the newcomers should be extensive consumers of the Company's gas.

Mr. Miles seconded the motion, which was carried unanimously.

The Deputy-Governor: I am very much obliged to you for your attendance. This completes our labours.

A Proprietor inquired whether the various pieces of land had been valued by the Company's Valuer, and the price agreed by the other side.

The Deputy-Governor: Yes.

Votes of Thanks—Sympathy with the Governor.

Mr. Henry Hills said that he had much pleasure in proposing a vote of thanks to the Governor and Directors. He was sure the proprietors had every reason to be well satisfied with the Board of Directors; and they all regretted the absence of the Governor.

Mr. William King, in seconding, said he should like to have conveyed to the Governor their sympathy with him in his illness, and their earnest hope that he would very soon be restored to health, so that for a long time to come he would direct the affairs of the Company and rule over that very ancient, interesting, and important concern.

The motion was carried unanimously.

The Deputy-Governor: We are very much obliged for your vote of confidence. We are, of course, handicapped by the absence of the Governor, and we shall be very pleased to convey to Mr. and Mrs. Woodall the motion which has been so kindly moved and seconded.

South Suburban Gas Bill.—The Erith Urban District Council, at a special meeting, have decided to oppose the Bill to authorize the acquisition by the South Suburban Gas Company of the undertakings of the Bromley and Crays Gas Company and the West Kent Gas Company.

Service by Candle-Light at Ilkeston.—The Derbyshire town of Ilkeston has come very prominently to the front of late. First came the gasholder disaster, and then a fire was caused by the fusion of an electric light wire. On Sunday, the 4th inst., the evening service at the Congregational Church was begun in darkness and ended by candle-light. The church, which has electric lighting, was in darkness when the congregation took their seats; and the organist found there was no current for the organ. While a deacon went in search of candles, the service proceeded; the Minister reading out the hymns verse by verse for the congregation to sing them. Eventually, forty candles were distributed; the members of the choir holding some, and others being placed on inverted flower-pots.

Little Hulton and its Gas Supply from Brackley Gas-Ovens.—The Little Hulton District Council have been advised by Captain Hart-Davis, Chief Agent to the Earl of Ellesmere, that, in view of a possible coal strike, the supply of gas to the Council's holder from the Brackley coke-ovens cannot be guaranteed except from day to day. With the object of guarding against the town and district being deprived of gas, the Council have asked the Earl of Ellesmere's Agent to reserve them sufficient coal to meet the requirements of the ovens for a reasonable time should a coal strike take place. It will be remembered that the Little Hulton district used to be supplied with gas by the Salford Corporation, but that some time ago the Council acquired the mains from the Corporation, having entered into an arrangement to be supplied with gas from the coke-ovens at Brackley.

COMMERCIAL GAS COMPANY.

The Half-Yearly Report and Accounts.

The following is the report for the six months ended Dec. 31 last which the Directors of the Commercial Gas Company will present at the half-yearly meeting on the 22nd inst.

The revenue account shows a net profit for the half year of £72,136 5s., which, added to the balance of £53,818 19s. 11d. brought forward, produces a net revenue balance of £125,955 4s. 11d. Deducting therefrom £8158 15s. 4d. for interest, there remains standing to the credit of the net revenue account a balance of £117,796 9s. 7d. available for dividend. The Directors recommend the payment of dividends at the rates of £5 9s. 4d. per cent. per annum on the 4 per cent. stock of the Company, and of £5 6s. 8d. per cent. per annum upon the 3½ per cent. stock, both less income-tax.

The accounts accompanying the report consist of the usual set of statements. They show that the paid-up stock on the 31st of December amounted to £996,405; that £1,076,875 had been added by conversion, making £2,073,280; and that £149,298 remained unissued out of the total authorized capital (including premiums) of £2,235,000. The total amount borrowed on the above-named date was £339,062 10s., and £135,937 10s. was added by conversion; making a total of £475,000, and leaving £79,226 to be borrowed out of the £550,000 authorized. Capital account receipts amount, with premiums, to £2,606,065 4s. 5d. The expenditure stands at £1,450,464 3s. 7d., with a nominal amount of £1,212,812 10s. added by conversion—together, £2,663,276 13s. 7d. There is thus a balance of £57,211 9s. 2d. carried to the balance-sheet. A sum of £1293 was expended during the half year on new and additional mains, services, &c.; but as £1200 is credited for prepayment meters and fittings, the net expenditure stands at £93. The reserve fund amounted at the close of the half year to £37,011; and the insurance fund to £33,073. The following is the

REVENUE ACCOUNT.

Expenditure.

Manufacture of gas—		
Coal and oil, including dues, carriage, unloading, and trimming	£85,565 2 3	
Salaries of Engineer and officers at works	2,749 12 3	
Wages (carbonizing)	11,085 5 3	
Purification, including labour	1,204 11 10	
Repair and maintenance of works and plant, materials and labour (less £277 8s. 2d. received for old materials)	37,294 14 9	
		£137,899 16 4
Profit sharing		3,513 2 8
Distribution of gas—		
Salaries and wages of officers (including rental clerks)	£4,976 3 3	
Repair, maintenance, and renewal of mains and services, material and labour	6,711 18 4	
Repair and renewal of meters	2 333 4 5	
" " " " stoves	10,052 9 8	
" " " " prepayment meters and fittings	10,876 14 3	
Incandescent mantle maintenance	751 5 11	
		35,001 15 10
Public lamps—lighting and repairing		2,749 11 6
Rent, rates, and taxes		15,137 19 0
Management—		
Directors' allowance	£1,250 0 0	
Company's Auditors	75 0 0	
Salaries of Secretary, Accountant, and clerks	931 4 11	
Collectors' salaries and commission	1,604 15 9	
Prepayment meter collection	3,360 14 1	
Stationery and printing	897 17 6	
General charges	1,368 17 3	
		9,488 9 6
Bad debts		567 1 3
Law and parliamentary charges		247 18 10
Superannuations and allowances		1,652 19 5
Official officers, &c.		106 18 10
Total expenditure		£206,365 13 2
Balance carried to net revenue account		72,136 5 0
		£2,8,501 18 2

Receipts.

Sale of gas—		
Per meter (No. in use, 106,918) at 2s. 4d. per 1000 cubic feet	£188,340 14 10	
Public lighting and under contracts	5,627 8 1	
	£193,968 2 11	
Less discounts and allowances	3,768 7 4	
		£190,199 15 7
Rental—		
Meters (23,820)	£2,844 18 11	
Stoves (66,828)	10,688 4 5	
Prepayment meters (82,353)	16,248 5 1	
Incandescent mantle maintenance	710 13 7	
		30,492 2 0
Residual products—		
Coke, less £4006 13s. 3d. for labour	£35,313 1 1	
Breeze, less £886 3s. 8d. for labour	1,116 11 6	
Tar	9,915 7 3	
Ammoniacal liquor and sulphate of ammonia	11,403 16 9	
		57,758 16 7
Miscellaneous receipts—		
Rent receivable	£16 9 0	
Transfer fees	34 15 0	
		51 4 0
Total receipts		£2,8,501 18 2

The following statements relate to the manufacturing operations :—

Statement of Coal and Oil.

—	In Store June 30, 1911.	Received During Half Year.	Carbonized During Half Year.	Used and Sold During Half Year.	In Store Dec. 31, 1911.
	Tons.	Tons.	Tons.	Tons.	Tons.
Coal	22,376	100,118	94,330	793	25,371
Oil—gallons	663,454	1,352,788	1,345,743	..	670,499

Statement of Residual Products.

Description.	In Store June 30, 1911.	Made During Half Year.	Used During Half Year.	Sold During Half Year.	In Store Dec. 31, 1911.
Coke—tons	1,405	58,956	8,378	45,562	6,420
Breeze—tons	2,248	9,108	..	7,983	3,373
Tar—gallons	416,198	1,128,124	..	1,114,937	429,385
Ammoniacal liquor—butts of 108 gallons	4,703	32,529	29,049	..	8,183
Sulphate of ammonia—tons	30	922	..	722	230

Statement of Gas Made, Sold, &c.

Quantity Made.	Quantity Sold.		Quantity Accounted for.	Number of Public Lights.
	Public Lights and under Contracts (estimated).	Private Lights, per Meter.		
Thousands.	Thousands.	Thousands.	Thousands.	
1,786,198	36,414	1,615,784	1,678,991	3898

The remaining statement is the balance-sheet, which gives the value of the stores in hand at the close of the half year as follows: Coal, oil, &c., £22,251; coke and breeze, £4630; tar, ammoniacal liquor, sulphate of ammonia, &c., £11,141; sundry stores, £33,087—total £71,109. The figures this time last year were: Coal, oil, &c., £20,062; coke and breeze, £2788; tar, ammoniacal liquor, sulphate of ammonia, &c., £8470; sundry stores, £32,714—total, £64,034. A sum of £21,170 stands in the balance-sheet as employees' bonus and savings, compared with £17,229 at the end of December, 1910.

BRISTOL GAS COMPANY.

The Annual General Meeting of this Company was held last Thursday—Alderman J. W. S. DIX (the Chairman) presiding.

The SECRETARY (Mr. John Phillips) having read the notice convening the meeting, the report and accounts were presented. The latter showed a balance of £99,913 carried to the profit and loss account, and £84,145 available for distribution; and the Directors recommended a dividend for the last six months at 5 per cent. per annum.

The CHAIRMAN, in moving the adoption of the report and accounts, said it was a great pleasure to be able to meet the shareholders with such a balance-sheet. It was also a further pleasure to report how excellently the staff generally worked and supported the directorate. To show the present position of the Company, he might say there was an increase of 2275 in the number of meters in use as compared with 1910, and of 1823 in the prepayment meters. This was, to his mind, a very healthy state of things, so far as small houses were concerned. He had anticipated it some years ago; and he was still convinced that all those people who had once had these meters and other conveniences would never be content to live in a house which was not furnished with them. There was also an increase in cookers; there being 2457 more out now than in 1910. He would repeat what he had said on previous occasions—that the time would come when there would not be a house of any note without a cooker within the area of the Company. There were increases in every department; the demand being so great that they were scarcely able to keep pace with it. They had extended their mains by 3⅝ miles, which was a healthy sign; and the increase in the make of gas was another—showing that, notwithstanding electric light and power, the Gas Company still went on increasing their output. He had not a shadow of a doubt that this would continue, for there was room for both; and as long as the Gas Company conducted their business on business principles, he had no doubt that they would continue to prosper.

The DEPUTY-CHAIRMAN (Mr. Fenwick Richards) seconded the motion; and it was carried unanimously.

Mr. J. H. HOWELL proposed the re-election of Alderman Dix and Mr. Fenwick Richards as Directors.

Mr. STOTHERT, in seconding the proposition, referred to the portrait of Alderman Dix which was recently presented to him by the staff [see *ante*, p. 270], and expressed the hope that he might be spared to preside at many more meetings. Alluding to the possibility of a coal crisis, he said he trusted the Company had adopted all measures to get in as large a stock as they could possibly deal with, so that they would be in the best position in case the strike came about, which they sincerely hoped would not be the case.

The resolution having been carried,

The CHAIRMAN returned his sincere thanks for the renewed proof of confidence. He said it was twenty-one years last March since the Directors chose him for their Chairman; but before that the shareholders had placed him on the Board. He hoped he might be spared some few years longer to meet them on such occasions as the present. With regard to the possible coal strike, he could not hide his opinion that he thought it was a mistake on the part of the men to demand a minimum wage. Economically, the position was untenable. Labour was worth a marketable value, and no one could stand against natural laws. The Board were alert to the position, and could be relied upon to do in the future, as they had done in the past, the best possible in the interests of the Company.

Mr. FENWICK RICHARDS also acknowledged his re-election.

Mr. PHILLIPS, referring to the portrait of the Chairman, said it had given great pleasure to the staff to present it to Alderman Dix. The idea, when broached, was taken up with a great deal of enthusiasm, and every member had contributed; for the Chairman had the respect of one and all.

The CHAIRMAN said he valued the gift as a mark of the good feeling which existed towards him by the whole of the staff.

The dividend was then declared, and the proceedings closed.

NEWPORT (MON.) GAS COMPANY.

In proposing the adoption of the report at the half-yearly meeting of the Newport (Mon.) Gas Company, Mr. T. G. Cartwright, who presided, expressed regret at the absence through ill-health of the Chairman (Dr. H. M. Brewer). Referring to the accounts, he said that the capital was practically the same as last time. Owing to the growth of the business, they would probably ask for a further increase of capital shortly. Unfortunately, they had not been able to get any relief in the price of coal. A dark cloud was now overhanging the coalfield; and they had been obliged to buy coal at an increased price. They hoped that some arrangement might be come to, and that peace might be arrived at. There were good and able men on both sides. During the last half year, the sale of gas had been satisfactory. The price was reduced last year by 2d. per 1000 cubic feet; and the demand for more gas had been gratifying. The Directors would be prepared to meet the public again in this respect as soon as it was possible to do so. There had been a slight decrease in public lighting, owing to some of the gas-lamps being replaced by electricity. Residuals were down; but the temporary slackness in coke sales might be righted by the cold weather. A large extension of mains had been made; and there was an increase of 318 consumers. They had now 12,514 cookers, 4046 gas-fires, and 118 gas-engines. In consequence of the satisfactory result of the half-year's business, they would be able to pay the usual dividend of 5 per cent., and the interest on the debenture stock, and carry forward a slightly increased balance.

The report was adopted; and a vote of thanks was passed to the Chairman, Directors, and officials. The Chairman, in response, said that at one time they could get coal at a reasonable price. They used to look to coal to reduce the price of gas; but now they had to look to science, and Mr. Canning and his staff, to help them. The Secretary (Mr. T. H. Hazell) remarked that the Company were making as much headway as at any period during their existence. The Engineer (Mr. Thomas Canning) also returned thanks, and said the Company had works of great importance in hand. The gas engineers of thirty years or forty years ago would be astonished at the present condition of things and the great changes which had taken place in the manufacture of gas. There had been much improvement in gas-fires; and he hoped there was a big future before them.

CAMBRIDGE GAS COMPANY.

A Prosperous Half Year.

The Half-Yearly General Meeting of the Cambridge University and Town Gas Company was held on Monday last week—Mr. E. H. PARKER in the chair.

The SECRETARY (Mr. A. E. King) having read the notice convening the meeting, the report and accounts for the six months ended Dec. 31 last were presented. The Directors stated that an application by the Company was now before the Board of Trade for a Provisional Order to include in the Company's area of supply the parishes of Great and Little Shelford, Stapleford, Impington, and Fulbourn. They considered it desirable to take the opportunity afforded by the application to obtain statutory authority to enable co-partners to dispose by nomination of stock and deposits held by them under the co-partnership scheme; and to empower the Directors, in the absence of a nomination, to transfer or otherwise dispose of such stock and deposits to or for the benefit of the family of a deceased co-partner. The accounts accompanying the report showed a balance of £6014 carried to profit and loss, and a sum of £22,962 available for distribution; and the Directors recommended dividends at the maximum rates, less income-tax.

The CHAIRMAN, in moving the adoption of the report, said that the balance on the half-year's working was sufficient to provide for the maximum dividend, with a small balance over. The Directors believed the position of the Company to be sound, as present indications were in this direction; but it was quite impossible to see how the price of coal would be affected if the miners succeeded in obtaining a minimum wage. If coal rose, of course, the price of gas, recently reduced to 2s. 7d. per 1000 cubic feet, must be increased. The present prosperity of the Company was proved in various ways, especially by the increases shown by all departments; and he might add that the make of gas for the half year had increased by 6,819,000 cubic feet. One of the features which caused the Directors great satisfaction was the steady decrease in capital charges per 1000 cubic feet of gas sold, combined, as it had been, with a similar movement in the price of gas. In 1898, the capital charges per 1000 cubic feet sold amounted to 10·57d.; and the price of gas stood at about 3s. Last year the figures were 7·58d. and 2s. 7d. This was due, he thought, to the careful working, which was telling its tale; and he considered the shareholders and Directors might thank Mr. Auchterlonie (the Engineer and Manager) and all those who worked under his very able direction for this good result. It was satisfactory to the Directors, but perhaps far more so to the consumers and the public. The Directors were pleased to be able to state that the co-partnership scheme was working well, and, they believed, was thoroughly appreciated by the employees.

The motion was carried unanimously; and the dividends recommended were declared.

South Hants Water Company.—The profit of this Company for the past year was £17,576, compared with £18,287 for 1910. The balance standing to the credit of profit and loss account is £18,722, out of which the Directors recommend the payment of a dividend at the maximum rate upon all classes of ordinary shares. This, with the interim dividend at the maximum rate paid in August, will absorb £13,662. It is proposed to transfer the sum of £1582 to the "back-dividends fund" (making, with the sum placed to that account last year, £2582), and to carry forward £3478. The Engineer and Manager (Mr. Dawson Kitchingman, M.Inst.C.E.) reports that the Company's works have been maintained in an efficient condition.

ABERAVON AND MARGAM GAS ARBITRATION.

The Award.

It will be remembered that last month an arbitration took place in London to determine the price to be paid by the Margam Urban District Council for such portion of the Aberavon Corporation gas undertaking (mains, &c.) as is within the area of the Council. The proceedings (which arose out of an Act obtained by the Council last year) lasted two-and-a-half days; and a report of what then transpired appeared in the "JOURNAL" for Jan. 23, p. 229. The arbitrators were Mr. Corbet Woodall and Mr. Harry E. Jones; while Mr. A. J. Ram, K.C., officiated as Umpire. After Mr. William Cash had submitted figures, Mr. William Newbigging and Mr. Henry Woodall gave engineering evidence for Aberavon; and Mr. Balfour Browne, who appeared for the Corporation, claimed (including 10 per cent. for compulsory sale) a total of £51,863. For Margam, Mr. E. H. Stevenson and Mr. Frank Jones put in a valuation amounting to £9441. The case for the Council, as put forward by Mr. Honoratus Lloyd, was that, in arriving at the maintainable profit, the tribunal should have regard to the fact that the trend of recent legislation was not to "allow a municipal trader to carry on business in such a way as to milk the consumers in outside districts in order to afford food for the ratepayers in the supplying district."

The award has now been given; the amount stated by the Umpire being £30,840.

BRENTFORD GAS COMPANY.

Half-Yearly Report and Accounts.

The Directors of the Brentford Gas Company, in their report for the six months ended the 31st of December, which will be presented at the half-yearly meeting on the 23rd inst., state that the accounts show a profit of £47,008. After providing for fixed charges, there remains a sum of £43,302, which, with the balance brought forward, makes £124,934 available for distribution. They therefore recommend the declaration of dividends at the rate of 5, 13, and 10 per cent. per annum, subject to income-tax, on the preference, consolidated, and new stocks respectively.

The accounts accompanying the report show that the revenue from the sale of gas amounted to £182,137; from meter and stove rents, to £25,913; and from the sale of residual products, to £44,065—the total receipts being £252,154, as compared with £253,152 in the second half of 1910. The expenditure on the manufacture of gas was £133,040; on distribution, £43,517; and on management, £8854—the total expenses being £205,146, compared with £204,919 in the six months ended Dec. 31, 1910. The balance carried to the profit and loss account is £47,008, compared with £48,253 this time last year; and the amount available for distribution is, as stated above, £124,934, against £102,693.

The working statements show that, under the supervision of Mr. Alexander A. Johnston, the Engineer and Manager, 86,180 tons of coal and 1,589,143 gallons of oil were used in the past half year in the production of 1,619,267,000 cubic feet of gas (including 573,840,000 cubic feet of carburetted water gas), of which 1,463,479,000 cubic feet were sold and 1,487,379,000 cubic feet were accounted for. The estimated production of residuals was: Coke, 53,955 tons; breeze, 7902 tons; tar, 1,126,590 gallons; and ammoniacal liquor, 30,273 butts.

CROYDON GAS COMPANY.

Half-Yearly Report and Accounts.

In the report to be presented at the meeting of the Croydon Gas Company next Friday, the Directors state that the sales of gas in the six months ended Dec. 31 last exceeded those of the corresponding period of 1910 by 3·71 per cent.; and the number of consumers increased in the half year by 1117. The number of stoves on hire has been augmented by 379 cookers and 1401 fires, while 57 and 326 respectively were sold to consumers—representing a total increase in gas-stoves of 2163. The larger amount of office and outdoor work arising from the growth of the Company's business and the more detailed attention given to consumers' requirements will necessitate an extension of the premises at Katharine Street. The Directors have been able, by acquiring the freehold of some of the adjoining property, to secure the land required for the purpose. By arrangement, a part of the property will be resold to the Corporation of Croydon, to enable a much-needed improvement to be carried out.

The accounts accompanying the report show that the total revenue was £125,023, of which £85,632 was derived from sales of gas, £10,268 from rental of meters, stoves, and house fittings, and £29,008 from disposal of residuals. A sum of £58,611 was expended on manufacture, and £18,425 on distribution; rent, rates, and taxes came to £4811; management cost £4631; and the total expenses (inclusive of £1300 for the co-partnership scheme) were £93,120. The balance carried to the profit and loss account is £31,903; and the amount available for distribution is £43,157. The Board recommend the payment of dividends at the rate of 15, 12, 10, and 5 per cent. per annum, all less income-tax, on the various classes of stock. This will absorb £23,524, and leave a balance of £19,633.

The statements relating to the working show that, under the supervision of Mr. J. W. Helps, the Engineer and General Manager, 44,907 tons of coal and 389,550 gallons of oil were used during the half year to manufacture 734,752,000 cubic feet of gas, of which 684,495,300 feet were sold and 693,189,800 feet accounted for. The estimated quantities of residuals produced were: Coke, 26,944 tons; breeze, 5485 tons; tar, 544,513 gallons; ammoniacal liquor, 1,252,351 gallons—the make of sulphate being 426 tons.

GAS CONSUMPTION IN EDINBURGH.

Suggestions for Increasing It.

In the "JOURNAL" a fortnight since (p. 310), we gave some extracts from a report presented to the Gas Commissioners of the Edinburgh and Leith Corporations by the Consulting Engineer (Mr. W. R. Herring) on a remit to him to consider the present position of the gas undertaking with the view of improving it. A similar remit was made to the Acting Engineer (Mr. A. Masterton) and to the Treasurer and Collector (Mr. A. Canning Williams), and we give below some lengthy extracts from their reports.

Extracts from Mr. Masterton's Report.

I have reviewed the Commissioners' accounts and statistics for the past ten years, and made up a statement [given in the report] of the gas sold during each of these periods, and compared the quantities year by year, showing increases and decreases where these occur, also the net total increase over the decade. The statement demonstrates, at the same time, how the various amounts have been consumed—viz., by ordinary and prepayment consumers, public lamps, stair-lights, &c.; the numbers of these, the increases and decreases under each head, and the gross annual revenue, with a few other useful and outstanding data indicating the growth of the concern. Looking carefully into these figures, it will be observed that during only three of the years taken are decreases in gas sold recorded—viz., in 1905-6, 1908-9, and 1910-11. The decreases were 0·41 per cent., 2·87 per cent., and 2·39 per cent.; the last year following a year (1909-10) of almost abnormal increase—viz., 4·27 per cent. Comparing 1911 with 1901, there is a total increase in gas sold of 144,841,200 cubic feet, equal to 8·27 per cent., though during that time the population within the Commissioners' area of supply has gone up by only 2·84 per cent. There is also an additional gross annual revenue of £14,652, notwithstanding that the price of gas has been gradually reduced to ordinary consumers by 8d. per 1000 cubic feet, in addition to which gas used for power and trade purposes has received special concessions. I also notice that at the last balance—May 15, 1911—there was a surplus in hand of £5748, equal to 0·73d. per 1000 cubic feet of gas sold. The total number of consumers has advanced from 80,405 in 1901 to 95,570 in 1911, equal to an addition of 18·8 per cent.

With regard to the causes which have resulted in the decrease in the gas consumption, which has been going on since the severe winter of 1909, and which still continues, in my opinion these are attributable to four circumstances—

1.—The changes in the atmospheric conditions, which again are subject to three important variations—viz., temperature, light, and humidity.
2.—The almost universal use of the incandescent burner in preference to the flat-flame, with special reference to the public lamps and stair-lights.
3.—The increased use of electricity for lighting, heating, and power.
4.—The overbuilding in Edinburgh and Leith, and the large amount of unlet property, chiefly in the older parts.

Mr. Masterton deals with each of these causes *seriatim*.

CHANGES IN ATMOSPHERIC CONDITIONS.

On this matter, Mr. Masterton says: "There is no doubt that the mildness of the summer and autumn which was experienced during the year 1911, with the attendant increase in temperature, clearness of atmosphere, and freedom from fogs and rain, has conduced in no small degree to a lesser amount of gas being consumed both in private houses and public works; and this increased temperature, with, in many cases, accompanying clearness of the air, is applicable, more or less, to the period under review." His contention is borne out by particulars of the daily consumptions, a few of which he tabulates, showing increases where the temperatures were lower than on the corresponding date in the previous year, and decreases where they were higher. Over all, the temperature had, he says, been decidedly warmer, as shown by another statement giving the average maximum and minimum monthly temperatures from May to November, 1910, and 1911, with the quantities of gas sent out from the Granton works.

INCREASED USE OF THE INCANDESCENT BURNER.

The greater utilization of the incandescent burner in preference to the flat-flame for public lamps, stair-lights, and private lighting has brought about a distinct reduction in the amount of gas consumed, but with a corresponding advantage to the users of this class of light; and anyone taking a walk through the city during the evening can obtain ocular demonstration on this point—the flat-flame burner being relegated almost entirely to the lighting of bedrooms, bathrooms, cellars, &c., which lights are only required for short intervals. In illustration of the foregoing assertion, I may state that, other things being equal, the consumption of a good average inverted incandescent burner amounts roughly to about one-half of that of an ordinary flat-flame burner with economizer.

In further demonstration of the above averment, I have prepared a statement [given in the report] showing comparative six-hourly consumptions from 1903 to 1911. It shows that whereas the quantities of gas consumed between 6 a.m. and 12 noon have increased year by year, and now stand at their highest, and at the same time the percentage of the total is also at its maximum, when the comparative quantities sent out between 6 p.m. and 12 midnight are looked at the exact reverse is found—viz., that the smallest amount was consumed in 1910-11; the percentage of the total in this division being likewise at its minimum. This, to my mind, proves that the encouragement of cooking by gas is responsible for the increase in the early part of the day, and the falling-off at the lighting hours may be attributed to the various causes already detailed, but chiefly to the more extensive use of the incandescent gas-burner and the multiplication of electric light consumers.

Turning to the record of consumption of gas for the last ten years in the public lamps, there is a considerable falling-off in this respect, as in the year ended 1907 (when the system of part lighting was authorized by the Edinburgh Town Council), when the consumption reached its high-water mark, 112,713,600 cubic feet were consumed; and the quantity has been reduced gradually year by year until in 1911 it amounted to only 82,660,000 cubic feet—a decrease of more than 30,000,000 cubic feet. I believe this is due partly to the lamps being converted from flat-flame to incandescent burners, and the greatly improved light therefrom leading to the suggestion which is now adopted—viz., that half of the lamps should be darkened at midnight from September to April, and a proportion of the lamps not lighted at all in the summer months. The decrease is also, to a certain extent, accounted for by the entire use of the inverted incandescent burner, which began in 1906 to replace the upright incandescent form which was first adopted, and burnt about 3 cubic feet per hour as compared with the present rate of 2¼ cubic feet per hour.

As to the stair-lights, the decreased consumption from 1907 (the year of maximum consumption) has been pronounced, as in that year 96,198,400 cubic feet were used and in 1911 only 67,811,900 cubic feet—a drop of 22,386,500 cubic feet. This may likewise be attributed to the incandescent burner, which in Edinburgh superseded the flat-flame burner in 1909-10, and which is here regulated to consume only 1 cubic foot per hour as compared with 1½ cubic feet per hour for the flat-flame. Of course, there are now a greater number of these lights, which have helped, to some extent, to compensate for the reduced output per burner. Against this, however, it has to be noted that many stairs are lighted by electricity. Although there is a marked falling off in revenue, the lighting of the common stairs in Edinburgh is now on a much sounder, more businesslike, and permanent basis. The Leith stair-lights are still of the open-flame type; but the officials there are presently experimenting with the incandescent burner.

INCREASED USE OF ELECTRICITY.

This is now an important factor in the reduced consumption of gas both for public lamps and private lighting; and I am inclined to think that the great strides being made by electricity are due, in large measure, to the fact that Edinburgh is favoured by having extremely low rates per unit—indeed, I believe that they will be found, if not the lowest in the kingdom, very nearly so; the terms being 2¾d. per unit for lighting and 1½d. per unit for power, with discounts for large quantities. But even at these prices gas is decidedly cheaper, both on the basis of luminosity and calorific value; and I attribute the advancement and large business done by electricity to the enormous amount of propaganda work and advertising being carried on, and to the fact that no opportunities are lost of representing it in the best possible manner, both by illustration and attractive advertisement. Indeed, one cannot look over any of the daily, weekly, or monthly periodicals without coming across advertisements, illustrations, and in many cases coloured cartoons, with reference to electrical appliances for lighting, heating, &c. It therefore behoves those interested in the use of gas for all purposes to combine in starting a campaign to bring the merits of gas and the up-to-date appliances for its utilization in a clear and attractive form before the public, and to combat the assertions, and at times misrepresentations, made by the electrical press.

It has occurred to me that the method of stating the price of electricity—viz., 2¾d. per unit—has been the means of attracting many customers; this figure appearing such a small one, and the average consumer having but a hazy idea of the capacity of the unit, and little or no knowledge for comparing it with gas. So that I calculate if the price of gas were quoted at so much per 100 cubic feet—viz., 3·2d. for lighting and 2·7d. for power, with notes as to the amount of light and power derivable from same, instead of 2s. 8d. and 2s. 3d. per 1000 cubic feet respectively—it would place gas on a much better footing in competition with the electric light.

I follow on with a comparison of these agents for lighting and heating. Taking 2¾d. as the price of a unit of electricity for lighting purposes, for this sum we can purchase 86 cubic feet of gas at the lighting rate. Now, according to the statement made by the Electricity Department, this unit will maintain a 16-candle power (carbon filament) lamp for 16 hours, which is equal to 256 candle-hours, for 2¾d. With gas, 86 cubic feet (2¾d.), burnt in a good inverted incandescent burner, will maintain a light of 90 candles for 30 hours, which is equal to 2700 candle-hours, for 2¾d., or more than ten times the amount of light given by an equal value of electricity. Of course, the Electricity Department may claim that much better results can be obtained by the metallic filament lamp; and this I admit. Taking a 32-candle power metal filament, a unit of electricity (2¾d.) will keep this alight for about 25 hours = 800 candle-hours per unit; and even against this, with the same gas-burner, nearly 3½ times the amount of light can be obtained for equal outlay. With intensified gas lighting, the difference is even more startling; but larger units have to be employed—250 to 300 candles. A lamp of this capacity will burn for twelve hours with 2¾d. worth of gas, and give fully 3440 candle-hours—more than four times the amount of light that electricity gives. With regard to renewals and maintenance, this may be taken as the same for ordinary and high-pressure gas and carbon filament electric lamps; but from two to three times this amount will be required for the metallic filament.

If we investigate the heating value of the two agents, taking the unit of electricity at the power rate of 1½d. we obtain for this sum 41½ cubic feet of gas at the power and trade rate of 2s. 3d. per 1000 cubic feet. A unit of electricity costing 1½d. contains 3412 units of heat, known as British thermal units (B.Th.U.), each of which represents the amount of heat required to raise the temperature of 1 lb. of water one degree Fahrenheit; and taking the quantity of gas of the same value (1½d.)—viz., 41½ cubic feet—this contains 590 B.Th.U. gross per cubic foot, or 540 B.Th.U. net per cubic foot, or a total of 22,410 net units of heat, equal to over 6½ times as much as the electric unit. So that, in addition to obtaining from 3½ to 4 times the amount of light from gas as from electricity, we also secure 6½ times the amount of heat. I consider it the duty of gas makers and distributors to bring these facts home to the popular mind in a thoroughly practical and convincing way, and to leave no stone unturned to educate the public in the best methods of obtaining the nearest possible approach to these results; for in this age of keen competition these remarkable facts are too little known.

I have probably made these statements in a somewhat broad fashion; but I have endeavoured to show them in as simple a guise as

possible, that they may be the more readily understood and appreciated. It is as yet hardly practicable to utilize the total amount of the actual heating value of the gas for domestic or industrial work. But to take a simple case—viz., the hot-water geyser—in this apparatus 95 per cent. of the available heat of the gas can be turned into useful work.

Overbuilding in Edinburgh and Leith, &c.

At first glance, this might seem to point in the opposite direction. But the reverse is the case, as it is found that the population has migrated from the older parts of the city, where gas was almost exclusively used, to the newer buildings, which are, with few exceptions, electrically lighted. And besides, at the last census, it was ascertained that the population within the Commissioners' area of supply had only risen from 415,521 in 1901 to 427,331 in 1911—a matter of 2·84 per cent., or a total of 11,810. It has already been pointed out that 14,165 new consumers were added in the same period—equal to 18·8 per cent. on the total. It is estimated that in Edinburgh alone there are 6783 uninhabited houses, unlet shops, &c., and in Leith 1931; and when the fact of the majority of these being fitted for gas consumption is considered, it is seen that, even taking them at an overhead rate of £1 per annum each, the loss of revenue can amount to £8714. Of course, I would not for a moment suggest that all these "empties" represent absolute loss, as we have been indefatigable in endeavouring to persuade builders of new property to provide pipes for combination ranges, cookers, gas-fires, wash-boilers, &c.; and our efforts have met with appreciable response. So that, in most of the new houses lit by electric light, provision is also made for using gas, and we can count a number of these as consumers, though perhaps not to the same extent as in the old premises.

In addition to the foregoing, it must be remembered that, in order to induce probable tenants to take up existing unlet property, in many cases the factors hold out the promise to fit the premises with electric light, if this has not already been done; and in other cases the tenants stipulate that electricity must be installed. In this way we gradually lose these premises for consumers, unless we obtain the introduction of pipes for heating, cooking, &c., by gas. The remedy I suggest to combat this is again judicious advertising, and educating the public to the possibilities, benefits, and economies of gas, and its adaptability to all requirements when used under modern and improved conditions, and with scientific and up-to-date instruments.

Another important matter in connection with the introduction of electric light into old property is that in many cases the existing gas-fittings are removed or rendered useless; so that in the event of a party wishing to revert to gas lighting the means of doing so have been destroyed. While on this subject, I may say that I am aware of people who would gladly go back to lighting by gas were it not for the great expense involved owing to the practice referred to.

Recommendations.

Passing on to the question of suggestions by which an increased use of gas might be fostered, this matter has already occupied the minds of the Commissioners in the shape of a proposed exhibition of gas appliances and preliminary lectures on cooking, &c., along with proposals for reducing the present hire-rates for cooking appliances and the fixing of gas-fires on the hire-purchase system. In connection with this, a record will be found in the minutes of the Commissioners of July 24, 1911; and, with this as a basis, I have prepared a further report on these proposals, which, with a few enlargements, briefly resolve themselves into the following recommendations for increasing the output of gas:—

(A) Proposed exhibition of gas appliances in Edinburgh in the autumn of 1912.
(B) Preliminary lectures on cooking, heating, &c., in the spring of 1912.
(C) Abolition of hire-rates for cookers and oven-burners, and the inclusion of grillers, hot-plates, &c., on free loan.
(D) Reduction in the hire-rates of gas-heated steam-radiators.
(E) Abolition of rents for meters used in connection with gas-engines and for trade purposes.
(F) Re-arrangement of selling prices and the fixing of gas-fires on the hire-purchase system.
(G) The adjusting of a uniform percentage on the purchase price at which articles could be sold to the trade.
(H) Joining in the publicity campaign, and becoming active members of the British Commercial Gas Association.
(I) Canvassing present non-consumers.

Remarks on the Recommendations.

(A) With reference to the Gas Commissioners' minute of July 24, 1911, wherein the Sub-Committee resolved to recommend the Commissioners that they should hold an exhibition in the spring or autumn of 1912, I beg to state that I have been in communication with the principal manufacturers of gas appliances and fittings, to ascertain if they were favourable to this suggestion, and if they would support such an enterprise, and to what extent. Generally, the majority would take space and exhibit; but they mentioned, both in their letters and at interviews which I had with the representatives of the makers with whom we have the largest dealings, that the spring would not be an appropriate time for such an exhibition, either from the Commissioners' point of view of increasing gas consumption or their own from a financial outlook. This is a conclusion one is led to on analyzing the Commissioners' business in conjunction with the seasons of the year; and it would appear that the best results would be obtained from, and the heartiest support for, an exhibition in the autumn, as at this time the nights are lengthening, and lighting arrangements are being overhauled and the latest appliances installed in readiness for the winter. This would ensure the co-operation of the makers of burners, mantles, fittings, glass, &c., and high-pressure lighting plant, along with the manufacturers of cooking and heating stoves, radiators, &c. Again, the temperature at this period of the year is beginning to fall, and people are looking out for heating and warming appliances. This means that radiators and gas-fires can be brought under their notice and advantages discussed. . . . I am therefore strongly of opinion that an autumn exhibition would be the best for all parties.

(B) As to the final recommendation by the Committee—viz., that the Commissioners might authorize preliminary lectures to be given in the spring of 1912, in Edinburgh and Leith, on the benefits to be derived from the use of gas cookers and fires, with examples of modern types of these appliances, as there has not been any gas exhibition held in Edinburgh for a considerable number of years, nor any demonstrations or lectures in connection with the construction and use of cooking, heating, and lighting appliances, I believe this to be an excellent proposition, and one which should be the means of hiring-out a larger number of gas cooking-stoves, with a consequent improvement in the consumption and revenue; and it would also encourage those who already use apparatus of this nature to retain it and utilize it to a further extent. By this period of the year (spring) the gas-fire business would be pretty well over; still, reference could be made to these contrivances, and some of the newest patterns placed on view throughout the halls, and a few hints given.

(C) The Commissioners have been hiring-out cookers since 1889, starting with the basis of about 10 per cent. on the price. This has been reduced from time to time until at present the rents vary from 4s. to 18s. per annum. The question of reducing or abolishing these hire-rates for cookers, &c., has been exercising my serious consideration for some time past; and, in my report of June, 1911, on a proposed gas exhibition in Edinburgh, I suggested the reduction of these rates. On maturer reflection, however, and with more up-to-date information regarding the practice in other towns, I now submit for your deliberation the question of dispensing with these hires. . . . In all cases where this policy has been introduced there has been a large demand for cooking apparatus, and a marked increase in the gas consumption, leading gradually towards a reduction in price of gas. . . . I firmly believe that, if the plan of loaning cookers were passed by the Commissioners, it would result (*inter alia*) in considerable saving by reducing the number of stoves which we presently have to remove—first from one house to another owing to change of tenancy; and, secondly, owing to discontinuance of hire for various reasons. I have prepared a statement [given in the report] showing the existing hire-rates for cookers in Edinburgh and Leith, and the percentages these hires represent on the prices of the stoves. The figures given therein show that we had 8957 stoves in use in May, 1911, the average yearly rental working out at about 5s. 4d. each. The estimated annual revenue to be derived from cooking-stove hires for the current year is approximately £2400, which, on the probable consumption, represents only 0·30d. per 1000 cubic feet of gas. The present capital value of stoves, as shown in the accounts for the year ended May, 1911, is £11,668; and the estimated revenue from hires represents a little over 20 per cent. on this capital value. A large number (about 16 per cent.) of the cookers at present on hire are on a nominal rent of 1s. per annum, and others are fast approaching this stage, and are many years old; so that we may safely say the majority of them have earned a considerable proportion of their value in hires, not to mention anything of the increased consumption due to them.

Approaching the subject from the point of view of return to the Commissioners in the shape of increased consumption and revenue, comparing Dundee, I find that in 1905, previous to the adoption of free cookers, they had 2264 stoves on hire; and the following year, under the new arrangement, they had 5784 appliances, including hot-plates, grillers, and gas-rings, of which 3334 were cookers; and in 1911, 21,069 pieces of gas-consuming apparatus, of which 8807 are cookers. I have no reason to doubt that similar progress would be shown in Edinburgh, though perhaps not quite in the same ratio.

Working on the Dundee figures, it is not unreasonable to prophesy that the Gas Commissioners might augment the number of cookers on loan by 2 per cent. on the number of consumers. This would equal, roughly, an addition of 2000 cookers in the year, involving an extra capital outlay of (say) £3800 or thereby; and on the further assumption that each of these would average an additional consumption of 15,000 cubic feet per annum, this would mean an increased output in the year of 30 million cubic feet. But we could also calculate on the fixing of at least 1000 hot-plates, grillers, &c., which should return another 10 million cubic feet—a total of 40 million cubic feet per annum, and an extra revenue of £5333. [Mr. Masterton gives a statement showing the estimated additional capital, charges, oncosts, revenue, &c., which would be necessitated by these proposals.]

The following advantages may be claimed for the policy of free cookers: The abolition of rents will necessitate fewer removals of cookers. It will ensure the older types of cookers being utilized, on the principle that, as they are on loan, consumers will not have full say in the matter of choice. It will increase the demand for gas, leading to reduction in price. It will be a concession to users of gas who have been the means of cheapening the cost. It will assist practically in securing a clearer, purer, and more healthy atmosphere, and will be a material step towards reducing smoke and also its abatement.

(D) Adverting to gas-heated steam-radiators, which are presently hired out at rates varying from 10s. to 15s. per annum, and which yield about £450 rental yearly, I would propose to reduce these charges by 20 per cent., which would equal £90 per annum; but this should be compensated for by increased business in this direction.

(E) With regard to gas-fires, I find that a number of gas companies and corporations in England and Scotland hire out these and fix them free of charge. However, I have ascertained that the commencing scheme in this line most favoured by gas concerns is to let out the fires on the hire-purchase system; and this would be the arrangement I would advise the Commissioners to adopt. In considering this proposal, I am of opinion that the terms should be made as easy as possible, consistent with guarding against any loss. I would recommend, as a basis, that 20 per cent. should be added to the present purchase price of fires; also that the estimated cost of fixing—an average (say) of 10s. per fire (assuming that the distance from meter to fireplace does not exceed 50 feet)—should be included, to which a further 6½ per cent. falls to be added for maintenance, and the total cost thus arrived at be divided over three years, and this again be subdivided into three terms per annum, so that these charges could be collected along with the ordinary gas accounts. My reasons for suggesting the addition of

20 per cent. on the present cost of the fire, in preference to a higher figure, are: (1) That I believe, in the event of this scheme being sanctioned, we would in all probability be able to secure more favourable discounts from the makers than now subsist; (2) we should be in a position to offer these appliances to the trade on much better terms than obtain at present; (3) that the useful life of a fire, in comparison with other gas apparatus, is comparatively short; and (4) that with the additions now proposed the price works out very little different from existing prices.

(F) I have ascertained that the existing practice with reference to gas appliances, with the exception of cookers and other domestic apparatus, is to charge the public 25 per cent. on the cost price, and allow the trade a discount of 15 per cent. on this latter figure. In looking more minutely into this, it resolves itself into practically charging the trade an additional 6¼ per cent. on the purchase price; and I am convinced that the Commissioners could with safety reduce this figure, charging an over-all addition of (say) from 3 to 4 per cent. to cover the bare cost of handling, storing, clerical work, &c. Again, in the event of the Commissioners becoming a somewhat central combination, their business would be so increased that they would be in a position to command special terms from the manufacturers; and these advantages would ultimately be to the benefit of the trade all round.

(G) When the Commissioners first decided to adopt a cheap rate for gas used through separate meters for special trade purposes, and in gas-engines for power, it was feared that the new arrangement might result in the Commissioners having to increase their capital by the purchase of a number of large meters to supply these engines, &c.; consequently, it was deemed advisable to introduce a meter-rental to cover the interest on this outlay. However, experience of the actual working of the scheme has disclosed the fact that these fears were to a certain extent unfounded. I may add that the introduction of these rents has been in some degree the means of preventing the expansion of business under this heading; and, as these charges only bring in the small sum of about £260 per annum, I would ask for your instructions to withdraw them, feeling confident their discontinuance would tend towards favourable reception by manufacturers, and be to our mutual advantage. The above recommendation does not apply to stand-by meters in connection with suction-gas plant.

(H) The necessity for bringing before the public the merits of gas for lighting, heating, cooking, and other purposes, along with the most up-to-date appliances for effecting this, has been felt for a considerable period by many gas engineers and others; and the outcome has resulted in the foundation of what is now known as the British Commercial Gas Association, which was formed in October last by those interested in the conference on gas publicity. This Association is intended to carry on the work of co-operative advertising for the benefit of the whole gas industry, as also to organize and stimulate, by means of exhibitions, lectures, demonstrations, &c., in every possible way, the commercial side of the business; and it is believed that the scheme has within it great possibilities for the enhanced prosperity of the gas industry. I would, therefore, respectfully suggest that the Commissioners should again give this matter their earnest consideration, and, if possible, make a contribution to the fund. The rules provide that, in proportion to the amount subscribed, the Commissioners are entitled to nominate representatives for membership of the Association, along with as many associate members as they deem desirable. There are already over seventy corporations and companies who have intimated contributions on the basis of 2s. 6d. per million cubic feet of gas manufactured per annum, which is the amount aimed at by the Committee, and which, in the case of Edinburgh, would amount to about £256. But I feel sure that a subscription of even £100 would bring in a remunerative return.

(I) For some time past I have had in process a survey of all the districts in the Commissioners' area of supply where gas is presently available, with the ultimate intention of ascertaining the number of parties not at present using gas, with the view of canvassing them for its introduction in one form or another. The survey is completed, and from it I learn that there are 2802 parties in this category, 998 of whom presently use electricity, and 1804 are made up of those who have no fittings available and use oil, candles, or other means of illumination. Among this latter class there are a considerable number of "undesirables"—viz., those to whom the introduction of gas would be an unwise and unprofitable measure. I reckon that about 1200 of the 1804 referred to would come under this denomination. However, I feel sure that a judicious appeal to the remainder—some 1600—would result in good business, for, as I have already represented, in most of the houses fitted for electric light there is provision made for the utilization of gas. I would therefore propose, with your assent, to make overtures to these parties, and endeavour to win them over as gas consumers; and, with the additional benefits detailed, we should, I think, be successful.

Having disposed of the probable causes for the falling-off in the consumption, and offered suggestions as to how business might be developed, Mr. Masterton gives the comparative costs of manufacture, distribution, &c., between Edinburgh and Glasgow, and concludes by saying he has endeavoured to put before the Commissioners, in as clear and concise a manner as possible, the vital points connected with the gas undertaking.

Extracts from the Report of Mr. A. Canning Williams.

Sale of Gas, 1900-1 to 1910-11.

During the ten years ended Whitsunday last, the sale of gas to ordinary and prepayment consumers has increased by 9·58 per cent.—say, an average annual increase of 1 per cent. In this period, the number of consumers has risen 18·86 per cent., or 9·28 per cent. more than the increase in the sale—showing that the average consumption of gas per head has fallen during the decade. This is a not uncommon experience in towns where special efforts have not been made to encourage the use of gas for cooking and heating purposes, and is doubtless accounted for by (1) the gradual substitution of incandescent for flat-flame burners; (2) the fact that the prepayment system of supply has added greatly to the number of small consumers; and (3) the loss of some of the larger consumers owing to their preferring the electric light. If this increase of consumers and decrease in the average annual quantity used should continue, the result will be that the expenses of distribution and administration per consumer will go up.

Notwithstanding an increase of 401 in the number of public lamps, and of 6071 in the number of stair-lights, the sale of gas for street and stair lighting last year was less by 5·53 per cent. than it was in 1900-1, and 25·84 per cent. less than in 1906-7. This decrease is principally due to two causes—viz., the system, started in 1907, of extinguishing nearly one-half of the street-lamps in Edinburgh at midnight, and the replacement of flat-flame by incandescent burners in Edinburgh stair-lights. Taking the total sale of gas for 1910-11, and comparing it with that for 1900-1, an increase is shown of 8·27 per cent., or an average annual increase of 0·83 per cent. [Mr. Williams gives a table showing the number of consumers, quantity of gas sold, and other particulars.] The make of gas for the six months ended Dec. 15, 1911, shows a decrease of 2·86 per cent.

Capital and Other Fixed Charges.

The undertaking labours under an abnormally heavy capital debt, which constitutes a severe handicap in these competitive days. This, as you are aware, has been brought about through your having to erect, out of capital, new gas-works at Granton, and abandon, some fifteen years after acquiring them, the works of the old Gas Company. The payment of the annuities and interest charges, the statutory contributions to the sinking and reserve funds, and the expenses of mortgages absorbed last year the sum of £112,371, or 1s. 2·23d. per 1000 cubic feet of gas sold. [Mr. Williams gives a table showing the figures for the years 1900-1 to 1910-11.] These obligatory charges have steadily increased from 8·79d. It should, however, be pointed out that the 1s. 2·23d. for last year includes 2·14d. for contributions to the reserve funds in respect of the dead capital, and that the increases in the capital charges have been offset to some extent by economies at the works. If the above 2·14d. be deducted from the 1s. 2·23d., the balance for capital charges and sinking fund contributions amounts to 1s. 0·09d., which is 3·73d. (say 3¾d.) in excess of the average of 73 other municipal gas accounts for 1909-10.

Expenditure on Revenue Account.

It has been suggested at some of your meetings that economies might be effected in the expenditure on revenue account; but, after carefully examining the accounts for the past seven years—*i.e.*, since the manufacturing operations were centralized at Granton—I am of opinion that not much can be expected in this direction. Indeed, if one reads the signs of the times aright, the cost of material and labour is more likely to rise than to fall. In support of my statement that there is little prospect of any considerable savings being made in the expenditure, I submit the following figures, which have been arrived at after deducting from the annual expenditure on revenue account (*a*) the cost of coal and gas oil, which has fallen materially since you discontinued the use of cannel coal, and which at all times is subject to market fluctuations; (*b*) rates and taxes; (*c*) pensions, &c.; (*d*) law and parliamentary charges; (*e*) discounts and bad debts; and (*f*) special items such as alterations to offices and dismantling old works:—

Year.	Amount.	Per 1000 Cubic Feet of Gas Sold.	Year.	Amount.	Per 1000 Cubic Feet of Gas Sold.
1904-5 ..	£82,368 5 0 ..	10·78d.	1908-9 ..	£83,658 4 3 ..	10·78d.
1905-6 ..	81,853 16 4 ..	10·76	1909-10..	84,457 8 3 ..	10·44
1906-7 ..	85,948 4 7 ..	10·81	1910-11..	84,969 7 7 ..	10·76
1907-8 ..	84,003 4 11 ..	10·52			

During the past year or two, economies in the administration expenses of my department have been accomplished. The estimated salaries for the current year are more than £1000 less than the salaries paid for the year 1908-9; and I hope to be able, as the older officials retire on superannuation, to bring about further economies. Then, too, the item "Allowances during the pleasure of the Commissioners to aged ex-employees" will gradually become extinguished; the superannuation scheme rendering additions to the list of voluntary allowances *ultra vires*. But these economies may be seen in their true perspective if it is borne in mind that a saving of £8000 a year would be necessary to permit of a reduction of 1d. per 1000 cubic feet in the price of gas.

Income on Revenue Account.

I do not think any useful purpose would be served by going elaborately into the question of income on revenue account, as this has naturally fluctuated with the price and the sale of gas and with market conditions as to residuals. I would, however, point out that the income from residuals during the five years 1906-7 to 1910-11 shows a considerable increase over that for the previous quinquennial period. The following table gives the annual income in respect of gas, residuals, stove-rent, &c., for the years 1900-1 to 1910-11:—

Year.	Gas (Net Sales), and Use of Prepayment Meters.	Price of Gas to Ordinary Consumers in Edinburgh and Leith.	Rental of Stoves.	Residuals.	Total.
	£		£	£	£
1900-1	274,988	3/- and 3/4	2649	41,762	319,399
1901-2	285,977	3/4	3007	35,721	324,705
1902-3	269,605	3/4 and 3/-	3164	51,239	324,008
1903-4	252,780	3/- and 2/9	3296	55,963	312,039
1904-5	248,933	2/9	3389	54,104	306,426
1905-6	247,706	2/9	3463	53,439	304,608
1906-7	258,875	2/9	*1762	59,192	319,829
1907 8	274,918	2/9 and 3/-	2643	68,728	346,289
1908-9	277,597	3/-	2676	62,257	342,530
1909-10	279,429	3/- and 2/10	2845	64,894	347,168
1910-11	256,991	2/10 and 2/8	2890	67,245	327,126

* Rental reduced, and system of charge altered.

The surplus revenue in 1910-11, with gas to ordinary consumers during the first half of the year at 2s. 10d. per 1000 cubic feet, and

during the second half at 2s. 8d., was £5748. The estimated surplus for the current year, with gas to ordinary consumers during the whole period at 2s. 8d. per 1000 cubic feet, is £552.

SUGGESTIONS FOR INCREASING THE SALE OF GAS.

(*a*) *That Cookers, Hot-Plates, Grillers, &c., should be Supplied Rent Free.*—I have shown that the consumption of gas, in spite of an increase in the number of consumers, is practically stationary; that the capital and other fixed charges manifest an upward tendency; that there is little prospect of a reduction in the rate of interest on borrowed money; and that the working expenses are more likely to rise than to fall—especially if the consumers increase, and the average individual consumption continues to shrink. In order to improve the position and prospects of the undertaking, it becomes necessary, therefore, to augment the sale of gas. How can this best be done?

First and foremost, I would suggest the abolition of rental charges for gas-cookers. It is clear, from the fact that only 9·37 per cent. of your consumers rent cookers, that there is wide scope in the district for the development of gas cooking; and nothing is calculated to aid this development so much as the discontinuance of rental charges, backed up with exhibitions, demonstrations, lectures, &c. The income from cooker-rental last financial year amounted to £2484, which is equal to a trifle under ½d. per 1000 cubic feet of gas sold. I am confident that if you adopted the policy of free cookers there would be a large demand for them; and the profit from the extra quantity of gas sold would give a good return on the capital invested.

In addition to abolishing cooker-rents, I would recommend the free supplying and fixing of hot-plates and grillers, and even boiling-rings, in order that the varying needs of the consumers might be met. This idea of rent-free cookers, &c., is no new one. It has been tried with success in a number of English towns—notably Manchester; and several Scottish towns have put it into practice, while others, including Glasgow, are stirring in the matter. [Mr. Williams gives particulars on this subject in regard to Manchester, Aberdeen, and Dundee.]

(*b*) *That Gas-Fires be Supplied on Hire and Fitted Free.*—My second suggestion is that steps be taken to encourage the use of gas-fires. At the present time, you supply gas-radiators on hire, and fit them free. A consumer, however, who wishes to heat an ordinary apartment by gas is obliged to buy the appliance, and bear the expense of fitting, &c. This is a serious obstacle in the way of the popularization of the gas-fire, and in a large number of towns it has been removed by the adoption of the hiring-out principle. I am not able to give the number of gas-fires in use in the district; but, as far as it is possible to judge, it is comparatively small. The field, therefore, is practically lying fallow; and if it were energetically cultivated on sound business lines, a rich harvest would be reaped.

I do not advocate the principle of free gas-fires, because, unless stringent conditions as to consumption of gas were imposed, which would largely defeat the object in view, it would lead to a large number of unremunerative fires being fixed. A consumer might have three or four fitted, and use two or three of them so seldom that a positive loss would result. In order to prevent this, a rental of (say) 10 per cent. on the cost of the fire should be charged; the rental to include the upkeep of the appliance. Another reason in support of charging rental for gas-fires is that they depreciate and become old-fashioned much more rapidly than cookers.

Manchester has just undertaken the letting-out of gas-fires, and they are being fixed at the rate of forty per day, "and" (writes my informant) "we expect to continue fixing them at that rate for some time." In many English towns, the practice has been in vogue for years, and has contributed largely to the prosperity of the undertakings adopting it. In the case of my late Company (Reading), a vigorous policy with regard to gas-fires has been and is followed; and in five years the number of these appliances on hire has risen 180 per cent. The sale of gas in the same period has also gone up by 20 per cent.—a result largely attributable to a forward policy with regard to cooking and heating by gas.

Many occupiers of the better-class houses in Edinburgh and Leith (as in other large towns) use electricity for lighting purposes—and are willing to pay the extra cost as compared with gas lighting—because they consider that this illuminant does not injuriously affect the decorations, &c., of the rooms. To such people the gas-fire should make special appeal, for the obvious reason that it would save the dust and dirt of coal-fires, and tend to still further preserve the decorations, as well as save expenses in other directions. I have little doubt, therefore, that if you were to decide to hire out gas-fires, a large number of applications for them would come from people of this sort, and fires supplied would be frequently used, and prove specially remunerative.

(*c*) *That more Generous Terms be Granted to Prepayment Consumers, and that the Use of Gas for Cooking be Encouraged among Them.*—My third suggestion is that the prepayment consumers should be treated with greater liberality, and that they should be induced to use gas more extensively for cooking purposes. The average annual consumption of gas by your prepayment consumers—*i.e.*, consumers who use gas through penny-in-the-slot meters—is the very low one of 6120 cubic feet. This is not surprising, when the large extra price that is charged to them is taken into account. In the period from 1900-1 to 1910-11, the extra price charged to prepayment consumers has varied from 10d. to 1s. 5d. per 1000 cubic feet; and the present extra price is 1s. 1½d. In January, 1910, however, you decided to allow rebates to prepayment consumers, according to the following graduated scale: Annual consumption of gas: 6000 cubic feet, 1d. per 1000; 7000 cubic feet, 2d.; 8000 cubic feet, 3d.; 9000 cubic feet, 4d.; 10,000 cubic feet, 5d.; 12,000 cubic feet, 6d.; and 15,000 cubic feet, 7d. This decision was duly given effect to, with the result that £590 has been paid back to the consumers in respect of the year to Whitsunday last. This £590 is equal to 2d. per 1000 cubic feet on the gas used by prepayment consumers last year, and reduces the average extra rate to 11½d.

I beg to recommend that, for the reasons given below, the graduated rebate system be discontinued, and that the extra price to prepayment consumers be reduced from 1s. 1½d. to 8d. per 1000 cubic feet, or, in other words, that the quantity of gas allowed for 1d. be increased from 22 to 25 cubic feet. The effect of giving this increased quantity of gas for 1d. would be to stimulate consumption, and induce many of the consumers to use gas for cooking purposes to a greater extent than at present. On the sale of gas last year through slot meters, this concession, after deducting the rebates, would amount to £1029.

The graduated rebate system has caused a large amount of trouble (chiefly due to the fact that changes of tenancy are very frequent among this class of consumer), delaying the collectors while on their rounds, and adding considerably to the office work. It has also been a source of dissatisfaction among the consumers themselves. In strict equity, the plan may be justified; but it is one that has not commended itself to the great majority of gas undertakings. I have communicated with the two largest London Gas Companies (657,869), with Birmingham (75,595), Dundee (18,336), Glasgow (57,068), Leeds (46,954), Leicester (34,783), Liverpool (65,803), Manchester (63,663), Newcastle-on-Tyne (62,741), and Nottingham (37,340), and in none of these places is the method of graduated rebates followed. [The figures between brackets represent the number of slot-meters in use.] The sale of gas by slot-meters is a retail business, and suits the needs of those who take their supply in this way. If a consumer should prefer to obtain gas on credit through an ordinary meter, he may do so on paying a small deposit; so that he is under no compulsion to buy his gas by pennyworths.

In making my recommendations with regard to free cookers, &c., and the hiring-out of gas-fires, I have had the ordinary (credit) consumers principally in mind. It seems to me, however, that in suitable cases these facilities, especially as regards cookers, grillers, and boiling-rings, should be given to the slot consumers as well.

(*d*) *That Gas-Cookery Demonstrations and Lectures be Given from Time to Time, and the Advantages of Gas for Cooking, Heating, &c., well Advertised in the District.*—If you should decide to supply cookers rent free, the fact will quickly become known, and orders will pour in. The subject of gas cooking will be "in the air." That will be the psychological moment to arrange gas-cooking demonstrations and lectures, and so drive matters home. It is one thing to have a cooker installed, and quite another thing to know how to use it to the best advantage. In some towns, expert lady cooks are permanently engaged; their business being to give public demonstrations of cooking by gas, and visit the homes of consumers—more especially the prepayment consumers—for the purpose of giving instruction in the art. In addition to public demonstrations, &c., it is usually found that the judicious distribution of advertising matter—especially when adapted to different sections of the community—is an investment which yields a handsome return. I therefore strongly advocate it.

GENERAL OBSERVATIONS.

If you should decide on a forward policy, it will be necessary to draw up the conditions under which you are prepared to grant such increased facilities as you may determine upon. But these are details which need not be gone into at the present time. I would only make this remark—that, if success is to be attained, the fewer the conditions the better. It would also involve a large amount of gas-fitting work; and the question will have to be considered as to whether this work shall be done entirely by yourselves or in co-operation with the local plumbers. Opinions as to the expediency of making working arrangements with local gas-fitters differ widely. There are some who strongly advocate it, while others as emphatically condemn it. The inference is that there is a good deal to be said for both methods.

If you should decide to do the work yourselves—and you have statutory powers to do so—it would probably cost less; but you would have to encounter some amount of hostility on the part of the "trade." The "trade" could scarcely say with fairness that you had taken work out of their hands, because, except in a very small way, it has never been theirs—a remark which applies with special force in respect to gas-cookers. My own opinion is that you might continue to fix cooking-stoves yourselves as hitherto, and that some arrangement might be made to share the gas-fitting work in connection with fires. The co-operation of local plumbers, &c., is, I think, well worth having; and any small extra expense that it might involve would probably pay in the long run.

In conclusion, if you should decide to give your consumers increased facilities for cooking and heating by gas, you will not only greatly improve the position and prospects of your undertaking, but you will also contribute to the health of the community by reducing the pollution of the atmosphere by smoke. It may be computed that the 9000 gas-cookers at present in use in the district save the consumption of at least 12,000 tons of coal per annum. If the number were trebled, and gas-fires more generally used, the smoke of upwards of 40,000 tons of coal a year would be done away with.

Sub-Committee's Recommendations on the Reports.

At the meeting of the Commissioners on Monday, Jan. 29, they had before them the interim report of the Sub-Committee who had been appointed to deal with the matter. Having considered the reports of the officials, along with a *précis* of the suggestions in the reports of Mr. Herring,* Mr. Masterton, and Mr. Williams, the Sub-Committee resolved as follows:

As to Gas-Cookers, &c.—They resolved, on the motion of Councillor Lyon, seconded by Bailie Pennell, to recommend that the Commissioners should offer to lease out cookers at the annual rent of 2½ per cent. on the cost thereof, fitted free by the Commissioners, and with a guaranteed consumption by the hirer to be adjusted later on.

As to Gas-Fires.—The Sub-Committee resolved to recommend that the Commissioners should let out gas-fires on the three years' hire-purchase system as recommended by Mr. Masterton; but in computing the hire rates, 10 per cent. is to be added to the purchase price, instead of 20 per cent. as proposed.

As to Lighting Installations.—The Sub-Committee resolved to recommend that the Commissioners should offer to introduce lighting installations under the high-pressure system, charging for their trouble

* Some extracts from Mr. Herring's report were given in the "JOURNAL" for Jan. 22, p. 310.

15 per cent. on the net cost; and meantime the Engineer be authorized to fit up an installation for street lighting in Waterloo Place.

As to Power and Trade Gas.—The Sub-Committee resolved to recommend the Commissioners to abolish the rent for meters used in connection with gas-engines, and with gas supplied for special trade purposes.

As to Prepayment Consumers.—The Sub-Committee resolved to recommend that the Commissioners should discontinue the graduated rebate system based on the annual consumption of gas, and should charge 10d. net per 1000 feet extra to the ordinary lighting rate for gas used through prepayment meters. Bailie Pennell dissented as to this recommendation.

Advertising, Exhibitions, &c.—The Sub-Committee resolved to recommend the Commissioners to adopt the first, second, and fourth recommendations by Mr. Masterton, but not the third.

Arrangements with the Trade.—The Sub-Committee instructed the Engineer to get up further information for them, and delayed consideration of this matter meantime.

General.—The Sub-Committee approved of the various suggestions by Mr. Masterton, and remitted to him to consider and report to them on suggestions as to having separate meters for lighting and other purposes; also as to returns received for residuals, and as to the expenses of repairs and maintenance of the works and plant at Granton.

The recommendations were remitted back to the Committee for further consideration.

DARWEN AND THE QUESTION OF GAS PROFITS.

An application by the Darwen Corporation for sanction to borrow £3600 for an extension of gas-mains was the subject of a Local Government Board inquiry last Tuesday. There was a large attendance of members of the Town Council and prominent citizens; it being understood that there would be opposition principally on the ground that the money required should have come out of revenue. The Inspector was Mr. R. H. Bicknell, M.Inst.C.E.; and those present included Mr. W. P. Halliwell, the Town Clerk; Alderman Cocker, the Chairman of the Gas Committee; Councillor Thomas Duxbury, a member of the Gas Committee and formerly Gas Manager; and Mr. A. H. Smith, the present Manager of the works.

The Town Clerk explained that on Dec. 31 the whole of the previous loan for gas-works purposes (£35,000) had been spent, and £514 besides, which was included in the £3600. It was estimated that the £3600 would last them for three years; the amount asked for being based upon the expenditure of the past three years. They had never before borrowed separately for gas-mains. The capital expenditure on the gas-works up to date was £227,573; and the present loans and capitalized value of annuities were £102,000.

Mr. Duxbury asked if the Local Government Board had power to grant the loan. It seemed to him that the Corporation, having exhausted their borrowing powers, should go to Parliament.

The Inspector said that if the Board had not power to grant the loan, it would not be sanctioned. He was not a lawyer; but he should say the Board had power to sanction the loan under the Darwen Corporation Act, 1889, section 136.

Mr. John Fish, a ratepayer, opposed the application, and pointed out in the course of his remarks that in the last twenty years the rates had risen from 4s. 8d. to 7s. 8d. in the pound. A refusal to grant the power applied for would not prevent those who favoured the scheme from contributing the money to enable their rulers to go on with it.

Mr. Duxbury said he opposed the granting of power to the Corporation to borrow this money, unless it was coupled with a condition that no more gas profits were given to the rates. He did not object to the money being borrowed and spent on gas-mains. What he did object to was the transfer of gas profits for the relief of rates and to other purposes. Many Parliamentary Committees were now refusing to allow municipal gas-works to make such transfers. The Darwen gas borrowing powers were now exhausted; and he suggested that they should go to Parliament instead of to the Local Government Board. It was his contention that gas, electricity, water, and tramways should, after providing a sufficiently substantial reserve fund, be worked at cost price—seeing that the customers not only paid the cost, but all the capital charges, including interest and a sufficient amount extra to redeem the capital, while the ratepayers as such did not pay one penny. In Darwen, the gas consumers had paid for other purposes £57,014; whereas the total money borrowed on mortgage for gas was only £54,562. If they had allocated this sum to their gas capital, they would now be paying from £3000 to £4000 less per annum in interest and sinking fund, and they would have been in a position to reduce the price of gas by this amount, besides having the works free from mortgage debt. In addition to paying—as he submitted, unjustly—this £57,014, the gas consumers in Darwen had paid to the sinking the sum required by the Local Government Board, amounting to £101,648. Adding to this annuities paid by gas consumers £103,902, and interest on loans £90,289, they had a grand total of £352,852 which the gas consumers had paid over and above the cost of making and supplying gas since the works were bought in 1877. Last year the Corporation transferred to the rates from gas a sum of £1000, though the gas profits were only £780. From the Electricity Department, £770 was transferred to the rates, though the profits were only £573; and from the Water Department £1400, despite the fact that the profits were only £1161.

The Inspector did not understand how they could transfer a larger sum than had been earned.

The Town Clerk remarked that they had not transferred anything that they did not have in hand. The Gas Department had, by resolution of the Council, a reserve fund of £5000.

Mr. Duxbury said there was no getting away from the fact that, though the profits on the gas undertaking were only £780, a sum of £1000 was transferred to the relief of the rates. Time after time had the reserve fund of £5000 fallen below this amount, and yet money was transferred in relief of the rates. On one occasion the gas-works lost £3800 on the year; but still the Council transferred £1000 from "gas profits" to the relief of the rates; and at the same time a resolution was passed by the Council to increase the price of gas 3d. per 1000 cubic feet, in order to bring up the amount in the ensuing financial year. On another occasion, the Corporation desired to borrow money for electricity purposes; but at that time there was an adverse balance on the department of £2000 on revenue, and it was explained that the Local Government Board would not grant further borrowing powers in the face of such adverse balance. Notwithstanding his (Mr. Duxbury's) protest, and the fact that electricity was being sold at less than cost price, it was decided, after a few minutes' discussion, to hand over £2000 from the Gas Department to the Electricity Department; and then the Corporation went before the Local Government Board with a clean sheet, and got the money. Now that the electricity works were paying, this department should refund the money it had had from the gas undertaking; and the Water Department should also refund the £20,000 it had when it was a losing concern. The delivery of gas to consumers in Darwen only cost 10½d. per 1000 cubic feet, *plus* capital charges; and if gas was sold at 1s. 6d. or 1s. 9d., hundreds of gas-fires and cookers would be fixed, less coal would be used, the atmosphere would be purer, the wear and tear on the streets would be less through diminished cartage of thousands of tons of coal, and they would have a smaller amount of ashes to deal with at the dust-destructor works. For 1911, the Darwen Gas-Works made a profit of £764; and it was expected that the current year would yield a profit of £2500. Yet the Council had decided to apply to the Local Government Board to borrow a paltry £1200 per annum for three years, while they had capital charges of 1s. 0½d. per 1000 cubic feet, compared with 3d. and 6d. in most towns.

The Inspector asked if Mr. Duxbury desired to convey the impression that there were a great number of ratepayers who were not gas consumers.

Mr. Duxbury replied that there were a large number of owners of cottages in Darwen who were absentee landlords. The tenants were gas users, and helping to contribute to the rates.

Alderman Cocker pointed out that a large number of the houses in Darwen—more than one-third—were owned by the people who lived in them.

Mr. Duxbury remarked that if everybody's rateable value was in proportion to the gas consumed, he would not have a word to say. It was his point that the large ratepayers benefited at the expense of the small consumers of gas. Alderman Carus, who had been Chairman of the Gas Committee for a long number of years, and had endeavoured to get the gas capital down to reasonable limits, was so disgusted at the Council insisting on borrowing this £3600, that he resigned the chairmanship.

The Town Clerk: Have you his authority to say that?

Mr. Duxbury: I have his authority to say he was disgusted with the proceedings. This application, he continued, was, in his opinion, a preliminary canter to a further application for £18,000 to £20,000 for retort-bench extensions, which had already been before the Gas Committee. Again he asked the Local Government Board not to grant this £3600, or, if it was sanctioned, that it should be on condition that no more profits be taken from the Gas Department and applied to other purposes. By doing this, the Board would be following the lead of Parliamentary Committees, and would be doing an act of justice to thousands of small gas consumers in Darwen, who were now forcibly robbed by a political caucus of 19 out of 24 members of the Town Council.

The Town Clerk protested strongly against this allegation. He said it was not true; and the statement ought not to have been made. While Mr. Duxbury had the right, as an expert, to speak as an authority on gas matters, he seemed to have got obsessed with the idea that the gas-works were simply and solely for the benefit of the gas consumers. The undertaking did not belong to the consumers, but to the whole of the ratepayers. Parliament said the only people to be recognized in this case were the ratepayers, who had to pay the losses on departments, while any profits that were made belonged automatically to the general body of ratepayers, to be disposed of as was thought best for the benefit and improvement of the town. It was quite true that the gas-works had made large profits since they were started, and that up to recent years the water undertaking had been a losing concern, and had been assisted by profits from the gas-works. But the profits made on the gas undertaking belonged to the ratepayers; and Parliament said the ratepayers could use such profits as they desired. His Council claimed that they were entitled to have something out of the gas undertaking; and every member of the Council, being a ratepayer, tried to act fairly and honestly in these matters. Mr. Duxbury had asked why they had not gone to Parliament with this application for £3600. The last time they went to Parliament with a Bill it cost £3162; whereas the expenses of the inquiry that day would be something like £3.

The Inspector did not think that was Mr. Duxbury's point.

The Town Clerk; No; but he wants to go to Parliament, because there would be a better chance of striking out these old Acts that we have; and my Council are not desirous that these Acts should be abrogated—for that is what it would come to. It was a fact that they had taken gas profits for other purposes; but in no single case had this been done unless the money was there. When in 1902 they took £1000 out of the profits of the gas undertaking, in the case mentioned by Mr. Duxbury, they had £4700 to their credit in the department. They had the money in hand, and transferred £1000 to the relief of the rates, as they were entitled to do. He submitted that the Council had been most moderate in dealing with the gas undertaking, and had done nothing to abuse the trust which Parliament had given them.

Mr. Duxbury said this bogey about the ratepayers' risk was always brought up when questions such as he had raised that day were put forward. He asked the Town Clerk if he could find a case where the ratepayers had helped the gas undertaking financially, at any time. Parliament was now reducing the powers of local authorities in the matter of gas profits; and he asked the Local Government Board to do the same.

The Inspector said he understood Mr. Duxbury to say that when there had been a loss in other departments, money had been taken from the gas profits to make it up; and but for this, gas would have

been much cheaper than it was to-day. He gathered also that Mr. Duxbury argued that sufficient money ought to have been put aside from gas profits to meet such an outlay as this £3600 for the extension of the gas-mains, in which case there would have been no necessity to apply to the Local Government Board.

Mr. DUXBURY agreed, and added that he had no objection to the loan being granted on the condition he had named.

Alderman TOMLINSON, a former Chairman of the Gas Committee, argued that profits made on any department belonged to the common purse, to be dealt with as the Council though best.

The INSPECTOR: Mr. Duxbury argues that gas should have a separate pocket altogether.

Mr. DUXBURY said he believed in "every tub standing on its own bottom." He did not object to the Corporation selling electricity if they made it pay. But he did object to its being sold at a loss, and another department being called upon to make this good.

This concluded the proceedings.

PUBLIC LIGHTING CONTROL AT STOCKPORT.

A proposal made by the Stockport Gas Committee that the control of the public lighting should be taken over by the Gas Department, gave rise to a lengthy discussion at last Wednesday's meeting of the Town Council. The resolution passed unanimously by the Gas Committee was that the control and supervision of the public lighting be delegated to them, subject to their agreeing to submit each year to the Finance Committee an estimate of the expenditure on public lighting account for the ensuing year—the Finance Committee to submit such estimate to the Council with their report thereon.

Alderman Fernley, the Chairman of the Gas Committee, said it had for a considerable time been felt by the Committee that the lighting of the town should be under their control. This question had been considered at conferences between Sub-Committees of the Gas, Electricity, and General Purposes Committees; but they had not been able to come to a unanimous decision. He submitted particulars to the Council showing that, by the adoption of the recommendation, there would not only be more effective lighting of the streets, but a material saving, as everything would be under the control of one Committee, instead of two as at present—the General Purposes Committee and the Gas Committee.

Opposition to the proposal was chiefly on the lines that, for the Council to adopt the recommendation would be unfair to the Electricity Committee, and that with a more reasonable charge for the gas used the General Purposes Committee could give a much more effective illumination of the streets than was the case now. It transpired that the cost of the lighting of the town for this year had been estimated at £8050, *plus* £500 for new lights and repairs, but that the General Purposes Committee expected this to be overspent. Mr. W. Thomas, the Chairman of the General Purposes Committee, said his colleagues on the Committee felt that they were being overcharged for everything they had from the Gas Committee. It would not be fair, with regard to the proposal of the Gas Committee, for the Electricity Committee to have to go to the former "cap in hand." Mr. J. Welsh, supporting the Gas Committee's proposition, said it was now pretty generally accepted that electricity was not a success for streets. There was no comparison between it and incandescent lighting. Mr. T. E. Forster remarked that the divided responsibility for public lighting had not been satisfactory.

Alderman Hopkins said that if the Council now accepted the recommendation, it would practically kill competition between the two illuminants, and the development of electricity for street lighting purposes would be considerably curtailed. Mr. J. Noden submitted that at present gas was much superior to electricity for street lighting. With the control of the public lighting in their hands, the Gas Committee would be in a position to consider the lighting of the principal thoroughfares with high-pressure gas. The Gas Committee could do more with the £8000 than the General Purposes Committee in street lighting, because the Gas Committee had facilities which the other Committee had not.

In his reply, Alderman Fernley said the position of the Gas Committee in this matter was absurd, because he was sure less than 25 per cent. of the people knew that the lighting was not under the control of that Committee. But for the fact that they had electricity to deal with, there would have been no hesitation in adopting the suggestion of the Gas Committee. There need be no fear that the electric light would not be fully considered; but at the present time it was generally admitted that electricity for street purposes was a failure. If progress was made with electricity in this direction, full scope would be given to it by the Committee responsible for the public lighting.

By 34 votes to 13, the Council rejected the proposal of the Gas Committee.

York Gas Company's Bill.—At a meeting on Monday of last week, Alderman Meyer moved the adoption of the report of the Gas Committee (*ante*, p. 387), in which it was recommended that the Council should oppose the Bill of the York Gas Company. He said the particular points to which the Council objected were: (1) The reduction in illuminating power, without a corresponding obligation to reduce the price; (2) the increase of the limits of supply, which, in the opinion of the Committee, was entirely uncalled for, and would probably result in an increase of price to the consumers in the present area; (3) the fixing of a high price like 2s. 10d. per 1000 cubic feet as the standard price, and a bonus of ½ per cent. for every penny below this price. The price of gas paid by ordinary consumers in the city was 2s. 2d. Some large consumers paid 1s. 11d. and penny-in-the-slot consumers paid 2s. 8d. Therefore the Committee thought that a price of 2s. 10d. was quite unreasonable. There were other points in the Bill which called for amendment; and on these grounds the Council in committee had decided to engage Counsel for the purpose of opposing the Bill. The resolution was carried.

STREET LIGHTING IN MANCHESTER.

Claims of Gas and Electricity Discussed by the City Council.

During the past week, the Gas Committee of the Manchester Corporation completed a further extension of their scheme for high-pressure gas lighting in the central thoroughfares of the city—Princess Street being added to the list, with four lamps each of 4500-candle power, suspended in the centre of the roadway by wires connected with buildings on either side. The lamps are so fixed that they can be lowered for cleaning and repairing without any interference with vehicular or other traffic. It is claimed for the new system that it is a distinct improvement on the electric lamps. There is no flickering in connection with the light from the high-pressure gas-lamps, as in the case of the electric lamps; the former giving a pure white and steady light. The Royal Exchange is now also illuminated by high-pressure gas; and the Gas Committee are satisfied that when shopkeepers realize the value of these lamps for lighting purposes there will be a great demand for them, especially if some slight concession is made in regard to charges.

At Wednesday's meeting of the City Council, Mr. Kay, the Chairman of the Gas Committee, had something to say about the extension of high-pressure gas lighting. First of all he drew attention to the steps which are being taken to bring the gas manufacturing plant of the Corporation right up to date. The introduction of vertical retorts would mark, he said, a new era in the making of gas in the city. The Council had already had the opportunity of judging this new system at the Droylsden works; and it had proved so satisfactory that it had been determined to go on with the work of placing their carbonizing plant on more modern lines. By the new system, the smoke nuisance and the annoyance caused by sulphurous fumes would be removed in such congested districts as Rochdale Road or Medlock Street, where they had works. In accordance with the methods of finance adopted by the Gas Committee, the cost of these changes would come out of the renewal fund. Therefore no necessity would arise for the borrowing of fresh capital, and no additional burden would be placed upon the ratepayers by the carrying out of these improvements. Turning to the resolution of the Gas Committee as to the supply of high-pressure gas to private consumers and the provision and maintenance of the necessary lamps, he expressed the hope that members would recognize the desirability of an extension of the system and of supplying gas at as near cost price as possible. As to high-pressure gas for street illumination, he submitted that the Gas Committee ought to be allowed to continue the work and provide lamps in other thoroughfares of the city on this system. This led him to say the Council should settle the point as to the Gas Committee being the lighting authority of the city. If the Council did entrust them with this responsibility, they could give such illumination as would be fully satisfactory to the citizens at large. He would go further, and say the Gas Department would give them better value and better light than they had ever had.

In the subsequent discussion, Alderman Walker argued that a fair chance should be given to the Electricity Department in the matter of street lighting, and accused the Gas Committee of "poaching" on streets with their high-pressure gas-lamps without the sanction of the Council. He suggested that the Council should not agree to any further extension of street lighting, either by gas or electricity, until the result of the test now going on in the centre of the city was made known. He moved as an amendment that the part of the Gas Committee's minutes dealing with the extension of high-pressure gas lighting be referred back.

This was seconded by Mr. Bowie, who said it was absurd that the two lighting Committees should always be at loggerheads. In his opinion, the difficulty would only be solved by the creation of an independent lighting authority for the city.

Mr. J. Billam held that, as the Gas Committee had been the only lighting authority up to the present, its members were quite justified in exercising that authority in the best interests of the community until such time as the Council put an end to that authority. He did not believe in conflict, but did maintain the right of the Gas Committee to demonstrate to the citizens the efficacy of gas for street illumination.

Mr. T. Cook said the evidence was that high-pressure gas lighting was in use in many of the most important thoroughfares in London, and that the average cost was 1·39d. for gas against 2·22d. for electricity. He had no objection to a Joint Committee; but as the Gas Committee were the street-lighting authority, he claimed that they were entitled to show to the Council and the public at large the advantages of any appliances that might be made for the improvement of gas lighting, particularly in regard to street illumination.

Mr. G. Howarth, the Chairman of the Electricity Committee, said he was quite convinced that the question of gas *v.* electricity for street lighting could not be satisfactorily settled at a discussion in the Council; and he hoped the Council would develop some authority which might be of advantage to all concerned. The best course would be to have a Sub-Committee to go into the whole matter; and then the Council would know the exact cost of the two systems. It was his desire to have a fair test made of the two illuminants without delay.

Mr. Kay, in his reply, denied that anything had been done in the way of extending the high-pressure gas lighting system without the sanction of the Council. As to the proposed test, he would welcome it; but the conditions must be equal. There were certain difficulties about the question of street illumination—the principal one being, What standard of candle power was necessary for the lighting of thoroughfares? Were the streets to have a blaze of light, such as they had on a show ground, or were they to be reasonably lighted? Then there was the question of charges. At present, the Gas Committee charged the ratepayers 2s. 3d. per 1000 cubic feet; but the price of the Electricity Committee was only 0·7d. per unit. How could the Gas Committee be expected to compete with the Electricity Committee under such circumstances? His Committee were not by any means averse to the appointment of a Joint Committee specially to deal with this matter; and he proposed to ask the Gas Committee at the next meeting to appoint a small committee to act jointly with one from the Electricity Committee.

The Lord Mayor (Mr. S. W. Royse) said it was most desirable that the Council should have a report as to the cost of both systems before coming to a decision. Until this was done, he did not think they should further consider the matter.

On a vote being taken, there were 44 in favour of the amendment and 42 against. Therefore the proceedings of the Gas Committee were approved, with the exception of those referring to high-pressure gas lighting, which were referred back.

SALFORD COAL CONTRACTS.

Proposal for the Publication of Prices Rejected by the Council.

Members of the Salford Town Council discussed again, at last Wednesday's meeting, the question of publishing on the *agenda* the prices paid for coal and cannel required at the gas-works. No new point was brought out by Mr. Bratherton, who moved the adoption of a resolution to the effect that the figures should be given, and that no bargaining should be permitted with the contractors.

Alderman Phillips, the Chairman of the Gas Committee, summed up the position as follows: The Gas Committee have a large sum of money to expend every year for coal and cannel. Particulars of all tenders and full details of each transaction are entered in the minute-books, which are open to the inspection of the members of the Council; and by law a ratepayer can at any time inspect the books on payment of a shilling. The members of the Gas Committee know every detail of the business of the Committee; and it is absurd to say there is any secrecy. It should also be remembered that people who buy in large quantities, as we do, can sometimes get substantial concessions. The Gas Committee have been very keen on getting concessions; and they have got them. Their money is safe, and those with whom they deal realize this. But the contractors are not prepared to sell at the same prices to others, and object very strongly to the publication of the figures. The gas undertaking is a huge business, in which the ratepayers have almost a million of money invested. If it is to be a matter of no account that the undertaking can contribute largely to the relief of the rates, then let the Council say so by a clear vote.

When the matter was put to the Council, 21 voted for Mr. Bratherton's resolution and 24 against it. The Mayor (Alderman Linsley) therefore declared the resolution lost.

MUNICIPAL EMPLOYEES AND THEIR WAGES.

The Lancashire Campaign.

The Lancashire branches of the Municipal Employees' Union continue their activities in the campaign for better wages and improved conditions of labour for members; but they cannot report any very substantial progress on the week.

At Stockport, a mass meeting of the men decided that, unless their demands were conceded, they would cease work. Meantime, however, it was resolved that a meeting of the ratepayers be called for the purpose of having the men's grievances ventilated. At Wednesday's meeting of the Town Council, particular reference was made to the agitation on the part of the gasworkers. Alderman Fernley, the Chairman of the Gas Committee, stated they were now dealing with the matter of work and wages at the gas-works; and he hoped to be able to make a full statement at the next meeting. Mr. W. H. Hollis, a Labour member, declared there was trouble in store for the Corporation at the gas-works, unless something was done quickly to put an end to the prevailing discontent. It was his hope that the Gas Committee would arrange conditions which would be satisfactory. Mr. Brewster deprecated the action of the men in organizing a public meeting, seeing that the Gas Committee were at present revising wages and conditions at the works. He believed the Committee had nearly completed their task, and advised the employees to await the result of the deliberations before they called a meeting to say whether or not there should be a strike. The Council decided to leave the matter till a report had been presented by the Gas Committee—the department chiefly affected.

At Rochdale, the three Corporation Committees employing carters—namely, the Gas and Electricity, Cleansing, and Paving and Sewering—have appointed representatives to a proposed conference on carters' wages. The Cleansing Committee have declined an application made by the Gas Workers and General Labourers' Union to re-open the question of the wages of the men employed in the sanitary works. There does not appear to be much truth in the rumour that there is unrest in the ranks of the lower paid hands at the gas-works.

The minutes of the Finance and General Purposes Committee submitted to a meeting of the Heywood Town Council last Thursday referred to an application on the part of the Municipal Employees' Union for increased wages to their members in the employ of the Corporation. The Committee resolved that the Chairmen and Vice-Chairmen of the departments affected be appointed to further consider the application and report. Alderman Smith, in proposing the adoption of the minutes, said the increases asked for would, if granted, seriously affect the Corporation accounts. He believed, however, that the men's demands would receive sympathetic consideration from the Special Committee appointed.

At Salford, the demands of the men include the following in the Gas Department: Yardmen, a minimum wage of 27s. per week; shiftmen, those in receipt of 5s. 3d. per shift to be paid 6s., and those receiving 4s. 3d. to have 5s. 3d. Councillor Jones, the Divisional Secretary of the Municipal Employees' Union, has written the Town Clerk that, unless the men's demands receive early consideration, the question of a strike will be brought forward.

At the Hull Law Courts last Tuesday afternoon, there was a sudden failure of the electric light; but fortunately sufficient daylight remained to enable the Court to conclude the business of the day. The breakdown affected other premises similarly; but the inconvenience was not general in the city.

NOTTINGHAM CORPORATION GAS AFFAIRS.

[From a Correspondent.]

Just as it seemed impossible for Mr. Dick to eliminate King Charles from his memorial, so it appears increasingly difficult for a section of the Nottingham ratepayers to keep matters relating to the management of the Corporation gas undertaking out of view whenever opportunities are afforded for exercising their votes at municipal elections.

Supplementary to the general appeal which took place last November, three contests to fill vacancies on the Council occasioned by death have recently arisen; and the burgesses, faced with the conflicting claims of the official Liberal and Conservative candidates, have had added to their difficulties the aspirations of an exceedingly militant body of Socialists, who incidentally have made much of matters appertaining to the work of the Gas Committee, of which Mr. Albert Ball, an ex-Mayor of the City, has now for some time been Chairman. The first of the contests, in a ward largely peopled by representatives of the artizan and labouring classes, was decided last week, when the Liberal nominee succeeded in again retaining the seat in a three-cornered contest, in which the claims of the Socialist candidate, Mr. A. Heyday, a former member of the West Ham Council, and now Nottingham District Secretary of the Gas Workers' Union, were espoused by Mr. Will Thorne, M.P., Secretary of the National organization, who spent a fortnight in Nottingham in commending the cause of his erstwhile colleague on the Metropolitan body. There are two other elections now pending, in which the Socialist interest (and incidentally questions as to the gas undertaking) are looming large. These have drawn from Mr. Albert Ball a significant reference as to the resignation by Mr. J. H. Brown of the position of Gas Engineer—the circumstances connected with which have given rise to much irresponsible speculation.

The Chairman of the Gas Committee, speaking on Friday night at a meeting in Manvers Ward, in support of the Conservative candidate, who is being opposed by a nominee of the "Reds," who already have held for a long time one seat in the ward, characterized as "clap-trap" some of the recent socialistic utterances as to the "mysterious" way in which some of the trading concerns of the Corporation are managed, declaring that for the so-called serious charges, both against Liberals and Conservatives, there was practically no foundation. They could be satisfactorily explained, he said; and although there might have been mistakes from time to time, taken generally the City's affairs had been well managed. As to the late Gas Engineer "disappearing in a mysterious manner," as had been suggested, Mr. Ball added that "that capable official went because he was not giving sufficient attention to the work. He resigned; he went himself." In view, however, also of the Town Clerk's recent entirely unanticipated resignation, the Socialists are making the most of a situation which they urge points to the necessity for some important changes in the *personnel* of the Corporation; and, in this connection, the gas workers, from their special interest in recent occurrences, are being assiduously canvassed. Mr. Thorne, with his lengthy experience of Trade Union work, and notably as a member of the Parliamentary Committee of the Trade Union Congress, devotes more than an ordinarily large share of his time to Nottingham affairs.

THE CANNOCK GAS PURCHASE QUESTION.

The District Council consider the Position.

At the Meeting of the Cannock Urban District Council last Tuesday, the subject of the proposed purchase by the Council of the undertaking of the Cannock, Hednesford, and District Gas Company was under consideration.

The Gas Committee reported the result of the poll [*ante*, p. 312]; that the Bill promoted by the Council would be withdrawn; that a resolution authorizing this should be formally passed; and that section 40 of the old Provisional Order would now operate. By this the Council could purchase the undertaking by arbitration on the basis of a sale by agreement, and not as a compulsory sale. To do so, however, it was necessary to be empowered by Act of Parliament, and to give twelve months' notice. The Committee did not make any recommendation as to this, as they considered that if any such action were contemplated it would be a matter for the full Council and the electors, from whom perhaps the initiative should now come. They desired, however, to point out that as the bank overdraft was £9800, and the limit allowed under the old Order was £10,000, it was obvious that if there were any general desire to purchase it would be to the advantage of the district not to delay until further capital had been provided. The Committee were not prepared to advise what effect the adverse vote of the electors might have upon the suspensory powers on the clauses in the new Order; but, if desired, they would report later.

By a strange irony, the Gas Company's balance-sheet for the past year was issued on the evening of the day of the poll; and the Committee expressed the wish to place on record the following figures: The gas sold in 1911 was 62,048,247 cubic feet; in 1910, 58,290,200 cubic feet—being an increase of 3,758,047 cubic feet for the year. The declared profits on the revenue account were £4191 17s., or sufficient to repay in forty years, at 3¾ per cent., a loan of £86,500. Further, the profit was arrived at after allowing £350 for Directors' fees, as against £293 in 1910. Salaries had been increased; and there had been carried to depreciation £938 1s. 2d. On the basis of Mr. Hunt's calculations, the amount of income available for the redemption of loan and interest would be as follows:

Declared profit	£4191	17	0
Directors' fees	350	0	0
Depreciation	938	1	2
	£5479	18	2
Less difference between depreciation and the 6½ per cent. basis taken by Mr. Hunt	509	0	0
	£4970	18	2

This was sufficient to repay a loan of about £98,000. The Committee submitted that these figures amply justified the action of the Council in recommending the purchase, and the opinion put forward by Mr. Hunt; and they expressed regret that, in an electorate of upwards of 5000, the actual voting on the purchase question was so small.

After some discussion, the report of the Committee was agreed to by eight votes to four.

RATEABLE VALUE OF PUBLIC UNDERTAKINGS.

The report of the Local Government, Records, and Museums Committee which will come before the London County Council to-day records that a return has been compiled from the quinquennial valuation lists in force on April 6, 1911, showing the rateable value, subject to appeals, of property in the occupation of public service authorities. A table in the report gives the total valuation for 1910-11 as £5,072,096, compared with £4,812,748 in 1905-6 and £4,517,734 in 1900-1. In these totals, gas figures for £923,924 in 1900-1, £895,742 in 1905-6, and £976,412 in 1910-11; electricity (including municipal undertakings engaged in its supply) for £202,729, £379,083, and £433,306; and water for £634,206, £684,584, and £635,280. In the course of their report, the Committee say: "While the total rateable value of all the public service undertakings showed a steady increase at the last two quinquennial valuations, there has been considerable variation in the totals for each class. Thus, railway and water undertakings, which each showed an increased rateable value of £50,000 at the valuation of 1905-6 compared with the figures of 1900-1, have now gone back practically to the 1900-1 totals. On the other hand, tramways, electricity, hydraulic, and telephone undertakings showed increases at each of the last two quinquennial valuations; while gas undertakings, which were reduced by £28,000 in 1905-6, have now been increased by £80,000. The rateable value of municipal electricity works and mains is £106,554, or about 25 per cent. of the total value of the undertakings. The rateable value of all the undertakings in 1911 (£5,072,096) represents 11·35 per cent. of the total rateable value of London—viz., £44,676,714."

STAFFORDSHIRE POTTERIES WATER SUPPLY.

Federated Council and the Water Company's Bill.

The important question of the water supply of the Staffordshire Potteries was debated at great length at a special meeting of the Stoke-upon-Trent Federated Council, held at the Town Hall, Stoke, last Friday—the Mayor (Alderman F. Geen) presiding. Mr. Brookhouse, the Chairman of the Water Committee, moved a resolution to oppose the Bill of the Staffordshire Potteries Water Company. He said the Committee felt that the Company had not met them reasonably, and certainly not generously. The Committee considered they should have adequate concessions from the Company if they were to deprive themselves and the next generation of the right to own the water supply of the district. Mr. Hayward seconded the motion. Alderman Elliott said he was anxious for concessions; but he felt that whatever concessions were made would not satisfy the section of the Council whose sole aim was the purchase of the water-works. He moved, as an amendment, that opposition should be proceeded with only in the event of the Corporation being unable to secure a uniform charge for water throughout the federation, and concessions in the rate for water used for sanitary purposes in houses from £6 to £10 annual rental. Alderman Goodwin seconded the amendment. The Mayor intimated that after Alderman Elliott's amendment had been disposed of he would move another amendment to the effect that the opposition should not proceed beyond the lodging of the petition, and that no expenses should be incurred without the specific direction of the Council. He said this would still allow them to negotiate with the Company, and to withdraw their opposition if they obtained concessions. Alderman Elliott's amendment was lost on a vote being taken; and on the amendment of the Mayor being submitted, it was carried by 39 votes to 34. Put as a substantive resolution, it was carried by the statutory majority.

Is It True?

Enterprising as ever, the Chichester Gas Company have recently issued a circular, the most prominent type on which puts the question Is it True? Two of the statements to which the inquiry refers are: (1) A dinner joint, with vegetables, pastries, &c., can be easily and beautifully cooked for less than 2d. (2) Breakfast bacon and eggs, and toast, with hot water for coffee, &c.; also for the after-washing-up, will cost about 1d. The Company have been supplying the answer at some demonstrations, of one of which the following report appeared in the "West Sussex Gazette" on the 8th inst.: "Some very effective demonstrations of what can be done in the cookery line with less than two-pennyworth of gas, when enthusiasm is guided by judgment, were supplied at St. Martin's Hall last Thursday. Under the auspices of the Chichester Gas Company, Mrs. E. J. Tyler, a local resident, and a user of the slot gas-meter, cooked, in presence of an admiring audience, a half leg of mutton weighing 3 lb. 10 oz., a quart of potatoes, Brussels sprouts, Yorkshire pudding, and a dozen mince pies, at a cost of less than 2d. for the gas consumed. Then she cooked with a pennyworth of gas a breakfast of bacon and eggs, and boiled the water for coffee and enough to wash up with afterwards. Mr. T. E. Pye, the Company's Manager, supplied supplemental information to inquiring minds, and pointed out some of the ways in which consumers of gas sometimes fail to do themselves justice." Mr. Pye believes these demonstrations are going to "take on." Some samples of excellent advertising literature that the Company have issued have also been received.

The Dey Time Registers, Limited, received last week an order from the Oldham Corporation Gas-Works for five of their weekly automatic "Dey" time registers.

FATAL SUFFOCATIONS BY GAS.

Last Tuesday morning, two female servants, engaged at a house at Beckenham, were found dead in bed; having been suffocated by gas. The victims were Jessie May Crake, the parlour-maid, and Daisy Boultard, the cook. They retired on Monday night in their usual health; but on their mistress going next morning to ascertain the cause of their non-appearance, she found their room full of gas, and the girls lying motionless in their separate beds. An investigation showed that gas fumes had entered the bedroom in some unexplained manner. At the inquest last Friday, it was shown that the gas by which the two girls were suffocated had percolated into their bed-room from a conservatory gas-stove pipe let into the chimney—the stove register being left open. The man who fitted the pipe said he understood that there would be no danger, as the register was never open. The Surveyor to the Beckenham Urban District Council (Mr. J. A. Angell) said it was no part of his duty to examine work of this character; neither had the work infringed the building bye-laws. The Jury returned a verdict of "Accidental death;" adding a rider that the Council should make a bye-law covering cases of the kind.

A tragic discovery was made last Tuesday morning at a house in Stepney, where a middle-aged couple, named Smith, were found dead in bed. The discovery was made by the elder of their two sons, who, on noticing that his mother had not, as usual, lit the fire in the kitchen, opened the bedroom door, and there found his parents both dead. On medical assistance being summoned, it was stated that both had been dead for about six hours. At the inquest on Wednesday, a police-sergeant, who was called to the house, stated that there were no gas pipes or fittings in it. Mr. F. W. Brown, the District Engineer of the Commercial Gas Company, said that excavations were made in the road after the occurrence, and one of the mains, which was 8 ft. 3 in. from the wall of the house, was found to be broken. The gas had percolated through the soil into the house by means of a flaw in the brickwork. Witness attributed the break to the recent severe weather. A verdict of "Accidental death" was returned.

A sad domestic tragedy occurred in a dwelling-house in Thistle Street, Glasgow, last Wednesday night. A woman called, and receiving no reply to repeated knocking, entered by the window. A strong smell of gas was at once detected, and on investigation John Kerr, a man of fifty, was found dead in bed. His wife was also found in bed in a comatose condition, and was removed to the Infirmary in a critical state.

When Shamus Warner, a well-known Swansea boxer, who lodged at the Vivian Arms Hotel, was called last Tuesday morning, he made no response. The daughter of the house smelt gas, opened the door, and tried to awaken him. She found the room full of gas, and at once gave the alarm and the windows were opened. Warner, however, was lifeless; and a medical examination showed that he had been dead for some hours.

Last Thursday, a railway shunter named Plank, living in Islingward Street, Brighton, was found, with his wife, overpowered by gas, the odour of which filled the house. Both were removed to the Sussex County Hospital, where the man succumbed. An examination of the premises was made; but no leakage could be found. Gas had, however, been smelt in the basements of adjoining houses.

SERIOUS GAS EXPLOSIONS IN BIRMINGHAM.

Fatality Due to the Recent Severe Weather.

A fatal gas explosion, indirectly attributable to the severe weather, occurred on Monday afternoon last week at the works of Messrs. Newey Brothers, Limited, of Brearley Street, Birmingham. The gas and steam pipes connected with the barrelling and japanning sheds were completely frozen in the morning, and work in these departments had been at a standstill. Men had been engaged in thawing the pipes; and about three o'clock in the afternoon the Engineer, George Palmer, went to one of the japanning stoves—the taps of which had been left open—to see if the gas supply had been restored. Unfortunately he carried a naked light in his hand, and when he stooped to open the door of the stove there was a violent explosion. The door—constructed of iron plates with a sand filling, and weighing about a hundredweight—was blown from its hinges, and Palmer was struck on the head, and his skull fractured. He was picked up in an unconscious condition, and conveyed to the General Hospital; but on his arrival there life was extinct. There were two other men in the shed at the time of the explosion; but both escaped injury. At the inquest next day, Mr. Frank Flavel, the Manager at Messrs. Newey's works, said Palmer was a reliable and experienced workman. The gas-fitting of the enamelling-stove, which was heated by three bunsen burners, would not light, and witness and deceased had spent some time examining the piping. Witness saw deceased stooping by the burners; and after the explosion he saw that the main tap of the stove was turned on. He turned it off; the bunsen burner taps had already been shut A verdict of "Accidental death" was returned.

A destructive explosion occurred last Tuesday night in Gordon Street, Garrison Lane, Birmingham; the effect being to partially wreck several dwelling-houses, and injure four persons. A leakage of gas was detected at No. 19, which is occupied by Mr. Sisman and his wife; and on Monday last week complaint was made to the Gas Department. In response, a gasfitter named Charles Wykes was sent to the house. Detecting a smell of gas, he disconnected the service from the street main. The meter was situated in a cupboard in the downstairs front room, and with the aid of a lighted candle he commenced to make investigations. He held the light some distance from the cupboard, but apparently the accumulation of gas was considerable; for no sooner was the door opened than there was a terrific explosion, and the room was wrecked. It was so severe that the partition walls of three adjoining cottages were much damaged—in fact, partially blown out. Mr. Sisman was sitting on a couch close to the meter cupboard, and was blown across the room. Wykes was hurled

backwards, and sustained a rather bad scalp wound. A police-constable who was on duty in the vicinity entered No. 19, which was filled with dust, smoke, and fumes, and brought out the injured persons. First aid was rendered, and then they were conveyed to the Hospital. Men from the Gas Department took up a section of the roadway, and cut off the gas supply as a precautionary measure. Having regard to the amount of damage done, which was considerable, it is fortunate that personal injury was not more severe.

WATER-HEATING BY GAS FOR DOMESTIC USE.

At the Central Technical School, Byrom Street, Liverpool, a few days ago, Mr. W. E. Fretwell, Lecturer on Plumbers' Work in the London County Council School of Building, gave an address on "Domestic Hot-Water Supplies." In the course of it he pointed out that, though gas-boilers are as yet in their infancy, they are destined to play an important part in the heating of water for domestic purposes, and become as ubiquitous as the gas-cooker. He said it was by no means necessary to instal gas-boilers to do the whole of the work of heating water, for a most important feature of these boilers is that they can be used to assist any type of boiler-range or independently to heat water when required. Fitted with a thermostatic valve, and coupled direct to a storage vessel, a gas-boiler might be aptly described as an automatic tank-heater. In the heating of water for any purpose, there was hardly a limit to its usefulness and application when intelligently selected and installed. Mr. Fretwell instanced some of the uses to which a gas-boiler may be put.

Passing on to refer to the required power of a gas-boiler, the lecturer remarked that provided the storage of water was not in excess of 20 gallons for each bath and 3 to 5 gallons for each lavatory basin and sink respectively, the boiler should be selected on the basis of its maximum gas consumption or fuel potentiality per hour, which, for ordinary household purposes and the like should approximate to 2 cubic feet of gas per gallon of net storage in the cylinder—extensive radiating surface being reduced to equivalent storage. For example, the gross storage required for a house with two baths, three lavatory basins, and two sinks was, on the foregoing basis, 59 gallons; and since the pipes and boiler would probably hold about 9 gallons, a boiler capable of burning, in round figures, 100 cubic feet of gas per hour when required would meet all possible demands. Since, however, the gas-boiler readily responds to any demand, the storage could be frequently reduced some 20 per cent. The efficiency of the gas-boiler was remarkably high; for instance, a transmission of 90 per cent. of the net calorific value of the gas was obtainable when the boiler was used as a geyser or as an instantaneous heater under favourable conditions. When it was desired to use a gas-boiler to heat radiators, there should be allowed ½ cubic foot of gas per square foot of radiating surface, and an average room would require anything from 15 to 20 feet of radiation per 1000 cubic feet of space.

Coming to the subject of the relative cost of gas and electricity, Mr. Fretwell said it might be easily shown by anyone conversant with the calorific value of each unit and the cost thereof. The calorific value of a unit of electricity was 3412 B.Th.U.; and the net value of gas in London about 550 B.Th.U. If the latter was supposed to transmit rather less than two-thirds of its heat to water, and the former 100 per cent., it would be seen that 10 cubic feet of gas were equivalent to a unit of electricity; and at the current price of gas in London (2s. 6d. per 1000 cubic feet) electricity was upwards of three times as costly as gas for the work. When they came to the question of the relative cost of heating rooms by gas as compared with electric radiators, they obtained in each case 100 per cent. efficiency, and the relative cost was as 1s. to 5s. in favour of gas.

The lecture was illustrated by numerous diagrams and drawings of installations; and it was repeated at the Grosvenor Museum, Chester. On both occasions, the lectures were well attended; several architects being among the audience.

THE HEATING OF DWELLING-HOUSES.

An Appreciation of the Gas-Stove.

The recent snap of severe wintry weather gave writers in the daily papers an opportunity of discoursing upon the different systems of heating dwelling-houses; and in the "Manchester Daily Dispatch" last Tuesday, Mr. Godfrey Dean made the following remarks appreciative of the gas-stove.

A central system of heating is the most scientific. Coke, ordinary house coal or anthracite furnace, gas, and electricity are the different means of generating heat, which is conveyed in the form of steam, hot air, or hot water, by pipes throughout the house. The temperature of each room can be controlled at will, or the heat may be shut off entirely. There is no waste, because every degree of heat given out by the central fire is utilized. There is no dust, and no time or energy is wasted. No attention whatever is required. All makes for economy. On the other hand, if a central system is not convenient, and the separate heating of rooms is necessary, the gas-fire or electric radiator may be installed as substitutes for the open fire. They are cleaner and more convenient. The gas-fire is certainly more economical than coal in the end; but the electric method of heating is not. Let us, however, see what the facts and figures are, and the relative expenditure on the different methods of heating.

At the present time, a hundredweight of ordinary house coal in London costs 1s. 8d.; in the Provinces it is less. One fire requires about a hundredweight per week to heat thoroughly an ordinary room. There is the difficulty of getting it, particularly when snow or ice is on the roads. It gives a lot of trouble to get it into the provincial cellar or back yard, or into the London tenement or flat. From the cellar or its equivalent to the grate means more labour and dirt. When it is burnt, after a certain amount of heat, more labour and dirt are occasioned to get rid of the ashes. That is the bad, old way of heating a room. It means a big bill, a big worry, and a big waste.

The scientific way of using coal is to convert it into gas and burn the gas. Thus we have fuel in a convenient and clean form, and the wonderful products that are wantonly thrown up the chimney when coal is burnt direct in the grate are saved. The more gas instead of coal is used in the home, the cleaner will be the atmosphere.

Gas fuel is used only as long as it is required. With a tap you turn the gas-fire on or off at pleasure. Coal-fires burn fuel to waste for hours when they are not needed. For this reason, gas-fires in bedrooms, drawing-rooms, dining-rooms, studies, and other "occasional" rooms are cheaper than coal-fires, as well as infinitely more convenient and useful. In many flats and large houses, the adoption of gas-fires generally in place of coal has enabled the mistress to dispense with one of her servants, or to do without one altogether.

The relative merits of obtaining heat by gas, by means of a gas-fire or a radiator, and electricity, by means of an electric radiator or convector, are somewhat in dispute. Heating by gas fuel is probably more economical than by electricity. One point that electricians emphasize is that electric lights differ from gas lights in that they do not make a room warm. How this statement is reconciled with the claims of electricity as a heater is rather difficult to see. But that by the way. The following, however, is the result of a test conducted in public, extending over 24 hours:

Gas-Radiator.—Rise in temperature of room, 22° Fahr.; cost of gas, 10d., at 2s. 9d. per 1000 cubic feet. (The average price of gas in London is 2s. 6d. per 1000 cubic feet.)

Electric Radiator.—Rise in temperature of room, 12° Fahr.; cost of electricity, 3s., at 1½d. per unit.

This shows to the advantage of gas of 10° Fahr. in temperature and 2s. 2d. in cost.

A room of average size can be kept comfortably warm on a cold day at a cost of ½d. or less per hour for gas, while with an electric radiator the same room might cost 2d. per hour to heat. The gas-fire of a few years ago has been vastly improved upon. Once antagonistic to gas-fires, the medical profession now strongly recommend them for sick-rooms, and use them in their own residences. Architects also use and recommend them. These two professions represent the hygienic standpoint in the case for the gas-fire.

COLNE VALLEY WATER COMPANY.

At the Half-Yearly Meeting of the Company last Tuesday, Mr. C. E. Keyser presided. After the Secretary and General Manager (Mr. C. P. Sinclair) had read the notice convening the meeting, the adoption of the report and accounts was moved.

In the course of his remarks, the Chairman stated that the total amount of the water-rates received for the past half year was £26,720, as compared with £24,185 in the corresponding half of 1910. The increase was therefore £2535, which made the total increase for the whole year £4068, and was a record for any one year in the Company's history. During the half year, 533 new supplies were added, estimated to yield an annual water-rental of £1443—making the total of new supplies for the year 1110, estimated to yield an annual water-rental of £2849. The total number of supplies in the district now amounted to nearly 20,500; and the population was estimated at about 113,000. Dealing with developments, he said that the present year would see many new railway stations opened in the area of supply, and other travelling facilities afforded, so that it might be confidently anticipated that, if anything, there would be as large a number of new properties erected as during the past years—in fact, the Company were already in negotiation regarding the development of new estates. The increase in the cost of maintenance and management for the half year compared with the previous corresponding period was £1029; the greater part of this being due to the drought. As the stockholders were aware, during the half year there was experienced one of the most prolonged droughts for years. The substantial nature of the Company's plant and machinery at Bushey, and the excellent state of its maintenance, was, if ever, amply demonstrated during the trying weather conditions referred to. But to meet the growing demand in the district, it was now thought necessary to establish the Eastbury pumping-station on permanent lines; and to admit of this being properly done, the Directors had found it requisite to purchase another acre of land. Contracts had been entered into for the erection at Eastbury of a beam engine and two Lancashire boilers as well as other work connected therewith, while the necessary buildings and equipment were now under consideration. The profit for the half year amounted to £17,469, of which sum the Directors had transferred £1000 to the contingency fund account, raising the balance of this account to £8912. After paying interest on the debenture and preference stocks, and recommending the full statutory dividends on the various classes of ordinary stock in addition to 1 per cent. (actual) on account of back-dividends on the "A," "B," and "C" stocks, a balance of £5603 was left to be carried forward. The Directors would shortly be issuing by tender £13,000 of "D" ordinary 7 per cent. stock at the price of £165 per cent.; the money being wanted to meet capital expenditure in the construction of the new works at Eastbury, for extensions of mains, and for general purposes. The profit required to satisfy the dividend upon the total sum was £910 per annum; whereas the surplus profit for the half year under review was £2382, after allowing for the debenture stock interest and the maximum dividends on the preference and ordinary stock already issued, and 1 per cent. (actual) on account of back-dividends on the "A," "B," and "C" stocks. In conclusion, he said that, owing to the continued labour troubles, the Directors deemed it advisable to keep a reserve stock of three months coal; and this quantity is at present in hand for any eventualities that may arise in the near future.

The motion having been seconded by Mr. A. Helsham-Jones, Mr. W. B. Bryan mentioned that recently he had been over the works, and was delighted to see the excellent stock of coal provided against any difficulty in the coal market. He was also delighted with what he saw in the engine-house, at the softening plant, and everywhere. The upkeep was excellent. After these gratifying remarks, the motion was adopted, the dividends mentioned by the Chairman declared, and the other formal business transacted.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

A heated discussion took place at Thursday's meeting of the Glasgow Corporation over the proposed retirement or superannuation of certain officials with salaries of over £300 per annum. Two of the number are Mr. A. B. M'Donald, the City Engineer, and Mr. James Fleming, the Treasurer of the Gas and Electricity Departments; and eventually a motion was adopted to the effect that it be remitted to a Special Committee to arrange for either the superannuation of the officials or for the retention of their services in a consultative capacity, on terms, in either case, not exceeding two-thirds of their present salaries, and to report.

An important question affecting local authorities has emerged under the new Scottish House-Letting Act. It has been remitted to the Town Clerk of Glasgow by the Corporation to prepare a report as to their powers regarding the inclusion or otherwise of the amount of occupiers' rates for stair lighting with the other rates under the House Letting and Rating Act, 1911. A difficulty has arisen in adjusting the amount which the Corporation are entitled to charge. The matter has been raised at the instance of the Association of House Factors and Property Owners.

At the meeting of the Edinburgh Town Council on Tuesday, it was reported that the mean of three analyses of the gas that had been made at the City Chambers showed an illuminating power of 17·05 standard candles, while the mean of three tests made at Granton showed a candle power of 17·18. At neither of the tests were there any traces of sulphuretted hydrogen or ammonia discovered.

Dundee of late has been remarkable for the large number of thefts from penny-in-the-slot meters which have been dealt with at the Sheriff Court. On Monday, this formed the subject of some comment by Sheriff Neish when a case of a similar kind was under review. One man was admonished and dismissed; in another charge the verdict was "Not proven." The learned Sheriff asked Mr. W. F. Macintosh, the Fiscal, why he brought these cases to him. There should, he said, be a special Court for gas-meter cases; and the Town Council, or whoever had to do with it, should be recommended to supply gas-meters which could not be so easily broken open. The Fiscal said that since the beginning of last year 300 of these cases had been brought to his notice, and 130 had come before the Court.

By a majority of ten votes to three, the Town Council of Falkirk, at their meeting on Monday night, decided to make application to Parliament for extending the burgh boundaries, with the view of opposing the Linlithgow and Falkirk Electric Lighting Order and at the same time adequately to safeguard the Town Council's gas undertaking in the Larbert, Stenhousemuir, Carron, and Carronshore districts.

At the meeting of the Dumfries Town Council held last week, out of a short leet of four, Mr. George A. Edgar was elected gas collector of the burgh. At the same meeting, it was reported that an arrangement had been come to whereby the firemen at the gas-works would get one whole Sunday off duty every third week. A remit was also made to the Gas Manager to prepare a report giving information on the following points: (1) Comparative cost of, and gas consumed by, the penny-in-the-slot and ordinary meters; (2) comparative cost of, and repair of, these meters; and (3) comparative cost of collection.

It was reported at a recent meeting of the Thornhill (Dumfriesshire) District Committee that they had now taken over the gas lighting of Moniaive village.

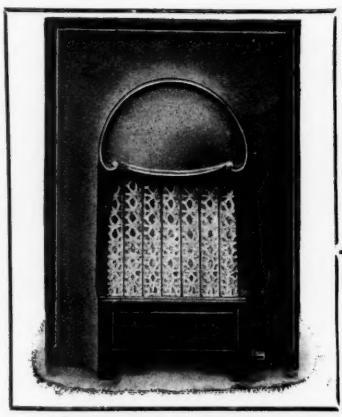
The Gas Committee of the Aberdeen Town Council report that the total cost of the gas exhibition held in October last was £363; while the receipts, including the sum of £100 voted by the Town Council, amounted to £390—leaving a balance of £27 available in connection with the gas-cooking demonstrations to be held this year.

At a meeting of the Edinburgh and District Water Trust on Thursday, Messrs. J. & A. Leslie and Reid were appointed Engineers, at the sum of £1000 per annum.

With a view to improving the water supply of Aberdour, Fifeshire, a new 6-inch main from Hillend to Inverkeithing is to be laid down, at a cost of £2600.

Gas Supply to Business Premises.—The Leeds Gas Committee have, we learn from the "Yorkshire Observer," expressed the opinion that it is desirable that the gas should be turned off at business premises at nights and week-ends; and they propose to fix the fittings necessary to enable this to be done. This action has been taken at the request of the Watch Committee; the object being to reduce the difficulty of dealing with any fires that may occuron such premises.

Grantham Gas and Water Supply.—In the report presented by the Directors of the Grantham Gas Company at the half-yearly general meeting last Tuesday, they stated that there was a balance of £4440 to the credit of the profit and loss account. Out of this sum they recommended that £2000 should be applied in payment of the maximum dividend of 5 per cent. per annum on the consolidated stock, that a further sum of £500 should be placed to the credit of the reserve account, and that the balance of £1940 should be carried forward. At the half-yearly meeting of the Water Company on the same day, the accounts showed a balance of £3305; and the Directors proposed that £2000 should be employed in the payment of a dividend at the rate of 5 per cent. per annum for the half year, and that the balance should be carried forward. In moving the adoption of the report, the Chairman (Mr. J. G. Thompson) said the Company had passed through an abnormal season. During the first nine months in the year the rainfall was only 11·8 inches; and the average for the past 35 years was 23·55 inches per annum. Notwithstanding this, however, there had never been the least cause for anxiety as to the water supply of the town, though there was a large and still progressive increase in the consumption.



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When you place a Gas Fire on hire you wisely consider the maintenance cost.

The number of separate parts; the facility with which these parts can be removed or fitted; these are only two of the many points to which you direct your attention.

In the "D.S.O." Fires the number of parts has been reduced to a minimum; the burner, bricks, fuel, fuel holder, are all fitted and removed without the use of screws; it is not necessary to move the fender to get at the fuel, fuel holder, or brick.

These are a few of the reasons for the popularity of this series; and there are more to follow.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, Princes St., Oxford Circus, W.; 136, Renfield St., GLASGOW; 56, Broad St., BIRMINGHAM; 83, Old Market St., BRISTOL; 13, Whitworth St. West, MANCHESTER; 8, Exchange Place, Donegall St., BELFAST; 333, Queen St., MELBOURNE; and 12, Cunningham Lane, Pitt St., SYDNEY, N.S.W.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Feb.* 10.

Sulphate of Ammonia.

There has been less keenness displayed on the part of direct buyers throughout the week, both as regards home consumption and goods for export; consequently the tone of the market has hardly been so strong as that recently experienced. The requirements of middlemen have, however, proved to be sufficient to prevent any considerable decline in values; and the closing quotations are £14 7s. 6d. to £14 8s. 9d. per ton f.o.b. Hull, £14 8s. 9d. to £14 10s. per ton f.o.b. Liverpool, and £14 10s. to £14 11s. 3d. per ton f.o.b. Leith. Not much interest is now being shown in the forward position, and no first-hand transactions have been reported, but manufacturers continue firm in their views at £14 10s. per ton for February-June, and £14 5s. per ton for July-December delivery at the principal ports.

Nitrate of Soda.

The situation of this article has gathered further strength, and holders have again raised their limits; to-day's quotations being 10s. 4½d. and 10s. 6d. per cwt. for ordinary and refined qualities respectively, on spot.

LONDON, *Feb.* 12.

Tar Products.

The markets for tar products are still very steady. Pitch has been in good demand, and there has been a slight improvement in the price. Benzols are quiet, with lower quotations in some quarters. Naphthas are firm and in fair demand. There is still a very good inquiry for creosote; and contracts have been placed during the past week at to-day's quotations. It is very difficult to do business in crude carbolic at the moment.

The average values during the week were: Tar, 24s. 6d. to 28s. 6d. *ex* works. Pitch, London, 46s. to 47s.; east coast, 46s. 6d. to 47s. 6d.; west coast, Clyde 45s. to 45s. 6d., Manchester 44s. 6d. to 45s., Liverpool 45s. to 46s. Benzol, 90 per cent., naked, London, 10½d. to 11d.; North, 10d.; 50-90 per cent., naked, London, 10d.; North, 9½d. Toluol, naked, London, 10d. to 10½d.; North, 9½d. to 10d. Crude naphtha, in bulk, London, 4½d. to 5d.; North, 3¾d. to 4½d. Solvent naphtha, naked, London, 11d. to 11½d. f.o.b.; North, 10d. to 10½d. f.o.b. Heavy naphtha, naked, London, 11½d. to 1s. f.o.b.; North, 10d. to 10½d. f.o.b. Creosote, in bulk, London, 2⅝d. to 3¼d.; North, 2½d. to 2⅝d., salty; 2$\frac{5}{16}$d. to 2⅜d., liquid. Heavy oils, in bulk, 3¼d. to 3⅜d. Carbolic acid, casks included, 60 per cent., east and west coast, 2s. 10d. to 3s. Naphthalene, £4 10s. to £10; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1½d. to 2d. per unit, packages included and delivered.

Sulphate of Ammonia.

There is a fair amount of inquiry, but so far it has not had any effect on the prices. Actual Beckton is quoted £14 1s. 3d. to £14 2s. 6d.; outside London makes, £13 15s.; Hull, £14 7s. 6d. to £14 8s. 9d.; Liverpool, £14 10s.; Leith, £14 10s. to £14 12s. 6d.; Middlesbrough, £14 8s. 9d. to £14 10s.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a stronger demand for coal; the prospects of continued work being considered less assured. Shipments are fairly good at the time of writing; and prices are firm but irregular. In the steam coal trade, best Northumbrians are from 13s. 9d. to 14s. 3d. per ton f.o.b.; and second-class steams are from 12s. 6d. Steam smalls are in good demand at 9s. to 10s. per ton. The output is well maintained at present. In the gas coal trade, the demand is full for all qualities; and there have been rather heavy exports. Prices are firm. Best Durhams are from 14s. 9d. to 15s. per ton f.o.b.; and second-class steams are firm also at about 13s. 6d. "Wear specials" are rather scarce at near 15s. 6d. per ton f.o b. There has been a pressure of steamers in need of gas coal cargoes; but the abundant tonnage is now being worked off, so that there is not the delay that there was a week or so ago. The demand is full, and the heavy output of gas coal is readily taken up. Coalowners are not now, however, so ready to sell forward, even at the current high prices. Contracts are held back also, as the future of the trade is uncertain after the end of this month; and this applies more or less to Durham coal generally. In the coke trade, prices are steady. There is a fuller demand for gas coke; the price for good qualities being from 15s. to 15s. 6d. per ton f.o.b.

Scotch Coal Trade.

During the past week, the coal trade has been very brisk in the home market; while the strike of dockers on the Clyde has largely prevented loading for export. Quotations, f.o.b. Glasgow, may be given as follows: Steam, 12s. 6d. to 13s. 6d. per ton; splint, 14s. to 15s.; ell, 12s. 6d. to 13s. 6d.; trebles, 13s. to 13s. 6d.; doubles, 12s. to 12s. 6d.; and singles, 11s. to 11s. 6d. At Leith, the prices, f.o.b., are: Best screened steam, 13s.; washed trebles, 12s. 6d. to 13s.; washed doubles, 11s. 6d.; washed singles, 10s. to 10s. 6d.; and rough dross, 9s.

Failures of Water Supply.—A serious situation was discovered at Rugeley last Tuesday morning, when the water supply was found to be failing. Instead of 10 feet of water being in the reservoir, there was only 18 inches. Late on Tuesday, the supply had entirely ceased; and the town was left practically without water. Things improved on Wednesday, and late in the day the whole town had a fairly good supply. It was thought that taps being left open all night was the cause of the trouble, as no leakage could be found in the reservoir. There were also failures last week at Coseley (no doubt from the same cause), Sedgley, and other places in the district of the South Staffordshire Water Company; and water had to be supplied by carts.

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Leading Makers of SPIRAL GUIDED GASHOLDERS.

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Spiral Plates
Steel Tested
Special Rails
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Steady Action
Strong Details
Save Capital
Safe and Sure
Stand Severe
Snow Storms and
Stiffest Gales
Successfully.

From a Photograph showing the conversion of a Two-Lift Guide Framed Holder to a Four-Lift Spiral Holder of 3½ million cubic feet capacity, for the Newcastle and Gateshead Gas Company, to Plans and Specifications of W. D. GIBB, Esq., M.Inst.C.E., Engineer.

Claim by a Deceased Gas Worker's Mother.

At the Oldham County Court last Thursday, a somewhat unusual compensation case was dealt with. The applicant was Ada Travis, a widow, and the respondents were the Corporation of Oldham. The claim was for compensation for the death of Henry Travis, son of the applicant, a labourer at the Hollinwood Gas-Works, who, while climbing on a heap of coals, fell and sustained injury to his windpipe. The operation of tracheotomy was performed at Oldham Royal Infirmary, and from December, 1908, he lived with a silver tube in his throat; and he died from an abscess in the wound on the 2nd of October. Mr. Garside, the Deputy Town Clerk, said the widow of the deceased might have some claim to be a dependant. She and deceased were living apart under a maintenance order made in May, 1903, and her address was not known. The order was for payment of 8s. per week; and the deceased had been prosecuted several times for non-payment. The Judge assessed the compensation at £100, and allocated £85 to the benefit of the mother; leaving the remainder subject to a claim by the widow of the deceased if she should make it.

Abingdon Public Lighting.—At the meeting of the Abingdon Town Council last Wednesday, the Public Lighting Committee reported that they had arranged, subject to the approval of the Council, for terms of a new contract with the Gas Company for the lighting of the street-lamps. They were that the Company should in future be paid £5 17s. 6d. per lamp for the "A" lamps, £2 4s. for the "B" lamps, and £2 11s. 6d. for the "C" lamps. The "A" lamps are to be lighted and extinguished as under the present contract; the "B" lamps not to be lighted for a period of eight weeks from May 28 to July 22, instead of six weeks as hitherto; and the "C" lamps not to be lighted for seven nights, instead of six nights, about the period of the full moon. The contract is to run from June 24 next, and the reduction in price to take effect as from the 1st ult. The report was adopted.

Thawing Frozen Water-Pipes.—As the recent frost caused serious inconvenience in many houses, a correspondent of "Nature" (Mr. C. E. Stromeyer) has directed attention to a method of thawing ice in pipes which he has frequently put into practice and found effective. It is based on the principle that strong brine eats its way into the ice like an acid, and that the resulting diluted brine rises and makes room for the denser fluid. The method is as follows: "Close the main tap, and with a spanner unscrew the top of the valve of the frozen water-pipe and remove the small valve. Ball taps to cisterns may have to be unscrewed altogether. Insert a few feet of ⅛-inch rubber or lead tubing into the pipe, and pour concentrated brine into it through a small funnel. Replace the valve and cover, but leave the valve open; also open the main valve, and wait. If the ice plug in the pipe is only 1 or 2 feet long, it will have been eaten through in about an hour's time; if longer, the above operation should be repeated several times. The brine is prepared by boiling an excess of salt in water—say ½ lb. per pint; it should, if possible, be used hot, and renewed frequently."

Gas Profits at Ilkley.—The Chairman of the Gas Committee (Mr. J. W. Benson) informed the members of the Ilkley Urban District Council at their last meeting that since the gas-works were purchased in 1893, profits to the extent of £20,000 had been handed over in relief of the rates, after every financial obligation had been met. The net profit on the past year's working was £2577, which was a record in the history of the undertaking.

Shoeburyness Water Supply.—On behalf of the Local Government Board, Mr. P. M. Crosthwaite has held an inquiry with reference to an application by the Shoeburyness Urban District Council for sanction to borrow £2300 to enable them to so extend and alter the water-works as to obtain an increased supply. The Clerk (Mr. F. Gregson) pointed out that in the summer it was impossible to pump sufficient water to meet the demand without raising sand. Mr. H. Bertram Nichols, who had been engaged to advise the Council, explained that the proposal was to put displacement chambers in the well. From these the water would be pumped into settling tanks, where the sand would be separated; and then the water would be raised to the tower and distributed. Opposing on behalf of a section of the ratepayers and some members of the Council, Mr. Talmage asked that the matter should be delayed, in order that the Council might further consider their position and open up negotiations with the Southend Water Company and the War Department, both of whom were sinking new wells in proximity to the Council's area. Among others who spoke against the scheme, Mr. G. W. Cobbe (Consulting Engineer) expressed the opinion that it would be advisable for the Council to sink a new well.

Gas and Electricity at Teignmouth.—At the meeting of the Teignmouth District Council yesterday week, the Gas Committee presented a report recommending that the balance in hand of £268 for the year ending March 31 last should be carried to the credit of the general district rate. Mr. Beer, in moving the confirmation of the report, said the ratepayers would be glad to know that the undertaking was so prosperous. The report was adopted; and it was decided, on the recommendation of the Highway Committee, that the cost of the scheme for the improvement of the public lighting should be provided out of the profit of the gas undertaking, instead of out of the general district fund. Mr. French, referring to a proposal which had been considered at a special meeting that the Council should obtain powers to establish electric light works, explained that the project had been abandoned because of the cost which would be involved. They could not provide such works at an expenditure of less than £20,000 or £25,000; and if they were to extend the cables to the neighbouring districts, they would have to incur a large outlay with very doubtful results. Their borrowing powers were limited, and such a scheme would exhaust them, so that it would be necessary to obtain a Special Act of Parliament. Taking all this into consideration, the Council should think twice before putting a further burden on the rates. Mr. Wheatley said that in large towns considerable doubt existed as to whether incandescent gas would not, in the end, be better than electric light. It was much less expensive, and very efficient.

The Proof— is in the Heating.

No one uses a steam hammer to crack a walnut, and no one wants to use gas full on, when half the quantity would do the work as well.

Herein lies one tremendous advantage of the

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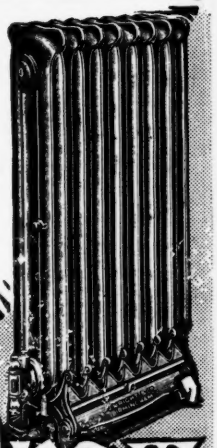
With its automatic valve, it burns the least amount of gas that will do the work of the moment. Other Radiators having no automatic valve, even if they have a gas-governor, burn one quantity of gas all the time, whether so much is needed or not.

This is only one of the reasons why the "ST. ANDREW" is the cheapest and best system of heating for Large Buildings, Warehouses, Shops, &c.; there are a host of others equally important.



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The St. Andrew

Cardiff Gas Company.

In proposing the adoption of the report and accounts at the annual general meeting of this Company last Thursday, the Chairman (Colonel W. Taylor, M.D.) congratulated the shareholders upon the very satisfactory progress made; the increase last year constituting a record. In order to meet the demand for gas, enlargement of the works had been carried out at considerable expense; and a further extension of manufacturing plant was under consideration. Referring to the strike disturbances in Cardiff last year, the Chairman said he wished to pay a tribute to the loyalty and devotion of the Company's workmen co-partners; and recognizing this fact, the Directors had made a general advance in wages, which had given great satisfaction. A considerable improvement had taken place in the sales of residual products. The gas exhibition held last October proved a conspicuous success; and had materially contributed to the largely increased demand for gas which the Company had recently experienced. The report was adopted. Dividends at the usual rates having been declared, a unanimous vote of thanks was passed to the Directors. The Chairman, in responding, paid a high compliment to the excellent services rendered by Mr. George Clarry, the Manager and Secretary, to whom a vote of thanks was accorded, also to Mr. H. D. Madden (the Engineer) and staff, for their co-operation and able services to the Company.

Improved Lighting of Westminster.—Referring to this matter last Friday, the "Evening News" said: "The Westminster City Council mean to assure the principal streets under their control becoming the best-lighted part of the Metropolis. With a view to improving the lighting of Whitehall, another powerful Keith light of 1800-candle power is to be placed just outside the War Office. It will cost £20 to erect, and nearly as much for its yearly maintenance."

York United Gas Company.—At the half-yearly general meeting of this Company last Thursday, the accounts presented showed a balance of profit of £8872. Adding the interest on the reserve fund, this was increased to £9260; and deducting the interest on the debenture stock, there was left a surplus of £8642. This the Directors recommended should be appropriated to the payment of a dividend of 4 per cent. per annum on the ordinary and preference stock (less income-tax); leaving £732 to the good. Compared with the second half of 1910, there was an increase of nearly 2⅓ million cubic feet in the quantity of gas sold. The Chairman (Mr. J. R. Hill) moved the adoption of the report and accounts; and the motion was carried. At the close of the ordinary business, the meeting was made special to consider the Bill which is being promoted by the Company. Mr. Cecil Cobb, Solicitor, explained the provisions of the Bill, which, as already stated in the "JOURNAL," proposes to extend the limits of supply, authorize the Company to construct additional works, raise more capital, and change its name. The Chairman moved a resolution approving of the Bill; and the motion was carried unanimously.

Walker and Wallsend Union Gas Company.

The annual meeting of this Company was held last Friday—Mr. C. J. Potter (the Chairman) presiding. The report presented by the Directors showed that the revenue in the twelve months ended Dec. 31 was £44,630, and the expenditure £30,995—leaving a balance of £13,635. This sum, added to the balance of undivided profits (£6799) and an allowance of income-tax arising on the obsolescence of old works, less expenses (£813), made a total of £21,247, which it was proposed to appropriate in the payment of dividends amounting in all to £12,807—leaving £8439 to be carried forward. In moving the adoption of the report, the Chairman stated that, after protracted negotiations with the Inland Revenue authorities, an allowance for income-tax had been recognized for obsolescence upon the plant and machinery displaced at the Walker and Willington Quay old works on an amount of £14,480; also a further allowance upon £1420 had been granted with respect to future annual wasting value upon the new works. The allowance, after deducting expenses, had been credited to net revenue, and had gone to augment the balance of undivided profits to be carried forward. The working in the past year had been satisfactory; and so favourable were the prospects that the Directors considered the time was opportune to reduce the price of gas to ordinary consumers by 1d. per 1000 cubic feet from the commencement of the year. The reduction, however, only allowed an increase in the statutory dividends of 2s. 6d. per cent.; while under the operations of the sliding-scale the consumers received, in the aggregate, considerably more than the shareholders—he thought in the proportion of 5 to 1. The employees under the co-partnership arrangement would also benefit by an increased bonus of 10s. per cent. upon their wages. The management were encouraging the use of gas for as many purposes as possible, and had been signally successful in installing the high-pressure system of lighting. They had already installed about 80,000-candle power; while, judging from inquiries, interest in the system seemed to be aroused in the district. Referring to the coal trade crisis, the Chairman said the Directors had stored as much coal as possible; and in this respect the Company were in a much stronger position than any other in the district. The report was adopted.

Heywood to Borrow £11,000 for Gas-Works Purposes.—The Heywood Town Council, at last Thursday's meeting, approved of the Gas Committee's recommendation that application be made to the Local Government Board for sanction to borrow £11,000 for gas-works purposes. Mr. D. Healey, the Chairman of the Gas Committee, informed the Council that the estimated cost of the installation of Glover-West vertical retorts was £9500; and it had been decided to strike off £1000 from the reserve for the loss of old capital due to the destruction of benches. It was proposed to spend £1000 on new mains, and £1500 on prepayment meters; the repayment in the case of the last sum to be extended over a period of three years.

"Striking" Opportunities

A FORCEFUL lever has been placed in the hands of the Gas Industry! The Coal Strike forecast, the high prices ruling for coal and the sudden spell of wintry weather are opportunities we have foretold for increasing the popularity of gas.

Many undertakings have increased their stocks and drawn on our still large stocks of "Model" and "Crusader" Gas Ranges, "A B C" Gasfires, "Monarch" Gas-Steam Radiators, Water Heaters, &c.

The special opportunities remain whilst the prices of coal rule high.

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Conviction for Theft of Gas.

At the Old Street Police Court last Thursday, Peter Martin, a Russian subject, described as an engineer, appeared before Mr. Biron on remand, charged with unlawfully stealing 1000 cubic feet of gas, valued at 2s. 6d., the property of the Gaslight and Coke Company. The facts of the case, as stated by Mr. Humphreys, who prosecuted, were given in the "JOURNAL" last week (p. 372). On the previous occasion, a remand was applied for in order to ascertain how long the alleged theft had been going on. A representative of the Company proved that no gas-meter had been fitted in the house for nearly three years; and other evidence showed that the prisoner had been burning gas surreptitiously since November, 1910. Mr. Humphreys said the quantity of gas consumed by the burners and gas-rings found in use in the prisoner's house was about 100 cubic feet per hour; and consequently a considerable sum would be due to the Company by the time the theft was discovered. Mr. Biron sentenced him to three weeks' imprisonment.

Increased Gas Supply at Swansea.—At the recent annual general meeting of the Swansea Gas Company, the report presented showed that last year there was an increase in the ordinary consumers to the extent of 6·27 per cent. and in gas cooking-stoves of 5·7 cent. compared with 1910. In proposing the adoption of the report and statement of accounts, the Chairman (Mr. John Glasbrook) mentioned that the Company's business in the last fifteen years had more than doubled itself; for in 1897 the gas made amounted to 250 million cubic feet, whereas last year it was 543 millions. He regarded the year's accounts as most favourable. The report was adopted and the usual dividend resolutions were carried. The thanks of the meeting were heartily accorded to the Chairman and Directors, and also the Manager (Mr. George Andrews), for their attention to the Company's business.

Chester Water Company.—At the half-yearly general meeting of this Company last Thursday, the Directors reported that there was a balance of £3997 on the dividend and interest account; and they recommended the payment of the usual statutory dividends on the consolidated and new ordinary stocks, less income-tax. In moving the adoption of the report, the Chairman (Mr. F. G. Roberts) said the Company had had a very uneventful half year, as everything had worked smoothly. The Act of last session imposed upon them the provision of additional storage for pure water; and they had no objection to it—in fact, it was exactly in accordance with their own wishes. The proprietors would be glad to know that during the past summer there had been no necessity for curtailing the supply, though so many towns had feared a water famine. It was one of the greatest trial tests the Company had ever had; and they had not failed. The report was adopted, and dividends at the rates of 7½ and 7 per cent. per annum (less income-tax) were declared on the consolidated and new ordinary stocks respectively. The Engineer (Mr. C. W. Bennett) reported that 366 million gallons of water was distributed during the half year.

Gas Manager's Claim for Compensation.

In the Norwich County Court last Friday, before his Honour Judge Mulligan, K.C., application was made by Mr. A. W. F. Bagge for a stay of execution in the action brought by Mr. John Stinton against the Brandon Gas Company, Limited, for compensation for the loss of a leg, in which, as reported last week (p. 372) judgment had been given against the Company. In making the application, Mr. Bagge said he was prepared to pay into Court the amount of the award. His Honour asked if it was proposed to pay nothing to the man—to leave him on parish relief till the appeal was heard. Mr. Bagge said this was so; the Company purposed paying the money into Court. Mr. Rowley Elliston, who represented the plaintiff, asked his Honour on general grounds to refuse the application, as he had power to do. His Honour, in giving judgment, reviewed the circumstances of the case, and asked how, being in receipt of parochial relief, the plaintiff could appear in London in support of an appeal. How was he—a poor wounded man with only one leg—going to instruct solicitor and counsel? He would not have the opportunity of appealing; and this was in opposition to all justice. The application was an attempt to prevent the man getting his rights and having a fair hearing; and it would be refused. Mr. Bagge said he would pay the money into Court, and proceed further.

Brighton and Hove Gas Bill.—It is stated that the opposition of the Hove Corporation to the Bill of the Brighton and Hove Gas Company will be of a formal character. The members deem worthy of encouragement the object the Company have in view—namely, to establish an employees' "benefit fund" out of revenue.

Acton Public Lighting.—At the last meeting of the Highways Committee of the Acton Urban District Council, the question of the street lighting was considered. An offer had been received from the Brentford Gas Company for lighting all the main streets with high-pressure gas, and the side streets with 60-candle lamps; the high-pressure lamps to be put out at 1.30 a.m. and 300-candle lamps substituted till sunrise. This, including £350 capital charges and the £220 annual capital electric light charge which the Council would have to pay if they reverted to gas in the main streets, would bring the total annual cost to £4079 for a five-years contract, or £3827 for a ten-years contract. If only 300-candle lamps were used in the main streets, the charge would be for a five-years contract £3630 per annum, or for a ten-years contract £3458 per annum. An offer of £2893 was also made for lighting the side roads with 1024 60-candle lamps. The Metropolitan Electric Supply Company offered a five-years contract to light the main roads with 64 1000-candle lamps from sunset to 1 a.m., and with 64 300-candle lamps from 1 a.m. to sunrise for £880, or 94 450-candle lamps from sunset to sunrise for £900. After comparing the figures, the Committee agreed to accept the Gas Company's offer to light the side roads for £2893 on a five-years contract. With regard to the main streets, consideration of the matter was deferred.

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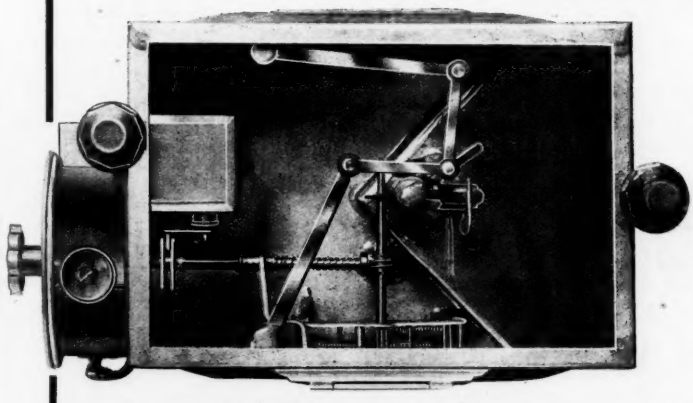

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Gas v. Electricity for Hospital Lighting.—It was reported by the Sanitary Committee at last Tuesday's meeting of the Worthing Town Council that alternative schemes for lighting Swandean Hospital by gas and electricity had been considered. They stated that the installation of gas would cost, according to the Borough Surveyor, £144; and the annual cost of gas for lighting and cooking was estimated at about £30. To instal electric light would, the Electrical Engineer considered, cost £350; and he put the annual cost of running and maintaining the plant at £71. The Committee were of opinion that, though more costly than gas, a system of lighting by electricity was preferable for many reasons. The Council, however, declined to accept the Committee's recommendation. Alderman Linfield said he could not imagine that, in a modern building, it could seriously affect the patients whether gas or electricity was used; and the electricity plant would be nothing more than a costly toy. Alderman Piper pointed out that electricity would cost £60 or £70 a year more than gas, and described it as more eccentric in its operation. An amendment in favour of lighting by gas was carried by a large majority.

Malton Gas Company.—At the half-yearly general meeting of this Company last Wednesday, the Chairman (Mr. Hugh W. Pearson) stated that they had had a fairly successful half year. There had been a very considerable increase in the consumption of gas as compared with the second half of 1910; and they were able to maintain their dividend at 6 per cent. for the six months, free of income-tax. The greater consumption of gas was partly accounted for by the fact that they had recovered the contract for the pumping of water for the town of Norton, and also partly by an increase in the number of prepayment meters, which were now a notable factor in the business. They had earned their dividend, which required only £1440, whereas the revenue profits were £1469; and they started the present half year with upwards of £100 more than they did the one just closed. The report was adopted, and the above-mentioned dividend declared. In the course of the proceedings, reference was made to the inefficient lighting of the streets of Malton by electricity; and one speaker remarked that if the contract had been in the hands of the Gas Company, there would have been such vigorous protests from the public that the District Council would have had to take prompt action.

TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending Feb. 10. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

Article.	Basis.	London.	North-East Coast.	East Coast, Yorks.	West Coast.	
					Liverpool.	Manchester.
Tar, crude	per ton	—	24/- 28/-	24/- 28/-	—	24/- 27/6
Pitch	"	45/-	46/-	46/3	—	43/-
Benzol, 90%	per gallon	1/0½	-/11¾	1/-	1/-	1/-
Benzol, 50-90%	"	—	-/11	-/11	-/11	-/11
Toluol, 90%	"	—	-/11	-/11	—	—
Crude naphtha, 30%	"	—	-/5	-/4½	-/5	-/4¾ -/5
Light oil, 50%	"	—	-/4¾	—	-/4¾	-/4¾
Solvent naphtha, 90-160	"	—	-/11	-/10½	—	-/10¼
Heavy naphtha, 90-190	"	—	-/11	-/11	—	-/11¼
Creosote in bulk	"	—	-/2⅝	-/2 5/16	-/2⅝	-/2⅝
Heavy oils	"	—	-/2¾ -/3	-/2½	—	-/2⅞
Carbolic acid, 60's	"	—	3/- 3/1	2/10	2/10	2/10
Naphthalene, crude drained salts	per ton	—	45/-	42/6	47/6	47/6 50/-
" pressed	"	—	60/-	63/-	60/-	60/- 75/-
" whizzed	"	—	—	—	70/- 72/6	65/- 75/-
Anthracene	per unit	-/2	-/1½	-/1½	-/1¼	-/1¼

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Claim in Respect of the Howellite Burner Patents.

In the Shoreditch County Court, a few days ago, Messrs. G. F. Redfern and Co. sued Mr. E. Bartlett for £23 12s., the balance of an account for work done by them in preparing the specification and drawings in connection with the Howellite burner. Defendant was the Managing-Director of Howellite Burners, Limited; and it was stated that when the time for filing the complete specification arrived he gave a personal undertaking that he would pay plaintiffs what was owing to them and any money that became due. On this undertaking the filing was done. For the defence, Mr. Bartlett said he was no longer connected with the Company. Mr. Howell, the inventor of the burner, died; and he (witness) saw plaintiffs' Manager (Mr. Allbut), explained what had happened, and told him that Mr. Brennard had been appointed executor of Mr. Howell's will. Plaintiffs then said the executor would have to give orders for completing the patent. He (witness) denied that he ever made himself responsible for the necessary money. Eventually his Honour Judge Cluer gave judgment for the plaintiffs for the amount claimed, with costs.

The Gas-Works Purchase Proposal at Wakefield.

The advisability of purchasing the gas undertaking was considered at a special meeting of the Wakefield City Council last Tuesday. The General Purposes Committee had recommended that, in order to protect the interests of the ratepayers, it was expedient that the Council should oppose the Bill which is being promoted by the Gas Company to secure further powers; and Alderman Simpson and Alderman Saville formally moved and seconded a resolution to carry this recommendation into effect. Mr. Evan Davies then moved, and Mr. G. Hill seconded, an amendment to the effect that an expert be instructed to report as to whether it was advisable for the Corporation to purchase the undertaking. Mr. Simpson, however, said it would be a mad thing to purchase the gas-works. Though the Company could make the undertaking pay, he did not think the Corporation could. The Corporation had a heavy debt; and he was not quite certain that the rates would remain at 8s. 10d. in the pound. There was quite sufficient work for municipalities to do without taking on every business in the country. The amendment was defeated by seventeen votes to nine—seven members remaining neutral.

Coatbridge Gas Company.

In the report for the year ended Dec. 31 last, presented by the Directors of this Company at the annual general meeting held last Tuesday, they stated that the total consumption of gas in the period named was 186,456,750 cubic feet; being an increase of 12,224,753 cubic feet compared with the previous year, or equal to 7 per cent. There was an addition of 174 to the number of ordinary and prepayment consumers; and the growing popularity of cooking and heating by gas, mentioned in the preceding report, was further evidenced by the gratifying increase of 1010 appliances hired-out during the year. The gross revenue for gas and residual products amounted to £30,290, and the capital expenditure was £832; while provision had been made for the maintenance and renewal of plant and buildings. The Chairman (Mr. J. Johnston, J.P.), in moving the adoption of the report, said the year 1911 had been a record one in the history of the Company; and the results reflected credit on the management and the staff. They were satisfactory to the Directors and the consumers, and he hoped also to the shareholders. They began the current year with a further reduced rate of 1s. 6d. per 1000 cubic feet for gas used for lighting, cooking, and heating; and, while they were experiencing some degree of anxiety over coal supplies, they were hopeful of continuing the new price throughout the year. The consumption of gas had gone up by fully 12 million cubic feet compared with 1910; and the prospect of a further increased use of gas during 1912 raised the question of augmenting, and possibly modernizing, the present carbonizing plant. These matters were engaging the attention of the Board. The Chairman concluded by moving the adoption of the report and accounts, and the declaration of dividends, in accordance with the sliding-scale, at the rate of £12 15s. per cent. per annum on the original stock, and £8 18s. 6d. per cent. per annum on the three issues of £10 shares, less income-tax. The motion was carried unanimously. A vote of thanks was cordially passed to the Directors and officials for their services during the year; congratulations being offered to them on the results achieved.

Perfecta Company, Limited, has been registered with a capital of £30,000, in 29,000 ordinary £1 shares and 20,000 preferred shares of 1s. each, to take over the "Perfecta" gas-generator, and adopt an agreement with the "E.B." Syndicate, Limited, the vendors.

The International Air-Gas Corporation, Limited, was registered on the 6th inst., with a capital of £16,000 in 15,000 participating preference shares of £1 each, and 5000 "A," 5000 "B," and 10,000 "C" shares of 1s. each. The offices of the Corporation are at St. Stephen's House, Westminster.

During the four days' severe frost in Liverpool and the subsequent thaw last Tuesday, upwards of 2000 cases of burst lead pipes and 56 of broken mains were reported to the Corporation Water Department; and the weekly consumption of water rose from 212 to 249 million gallons. The Water Engineer (Mr. Joseph Parry, M.Inst.C.E.) organized numerous gangs of men to give supplies from street hydrants when the house service-pipes were frozen.

A lecture on "Ski-ing" which was delivered by the Rev. L. G. T. Chaffey, of Eton College, in the Royal Albert Institute, Windsor, last Tuesday evening, had a premature ending owing to a short-circuit in the electricity supply. There were two failures; and when the lights were restored after the first, it was thought that all would be well. But unfortunately they went out again. It was suggested to Mr. Chaffey that he should give his lecture on a future occasion.

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LONDON (City)—15, Upper Thames Street, E.C.; (West End)—23, Princes Street, Cavendish Square, W., and 3, Berners Street, W.; LIVERPOOL—22-30, Redcross Street; MANCHESTER—24, Brazennose Street; GLASGOW—125, Buchanan Street; EDINBURGH—114, George Street; BRISTOL—6, Victoria Street; NEWCASTLE-ON-TYNE—13, Prudhoe Street; BIRMINGHAM—218, 220, 222, Corporation Street; DUBLIN—44, Grafton Street.

GAS COMPANIES' STOCK AND SHARE LIST.

Business on the Stock Exchange last week was generally quiet. It was not quite a case of suspended animation, but motion was arrested pending the development of critical factors. In home politics, the Chancellor's Saturday speech was not received with rapture; and the sinister possibilities of the Belfast raid loomed ahead. In social questions, grave anxiety concerning the upshot of the Coal Conference continued to oppress the Railway Market and commercial undertakings within the range of damage. Thus, nothing tended to improve prices; but some leading departments bore up pretty well. The opening on Monday was dull and lifeless. Consols fell ⅜ and infected other markets. Rails held on awhile, and then gave way; while Americans swung to and fro. Business remained quiet on Tuesday; but brighter views prevailed, thanks in a measure to monetary ease. Consols recovered ¼, Rails had an advance, and Americans amended. On Wednesday, the gilt-edged group were again supported. But the rest were dull; and rails were specially depressed by the Coal Conference coming to naught. Things were much the same on Thursday. The reduction of the Bank rate gave a fillip to Consols, which rose ¼. But Rails were still heavy, though the last prices were better than the worst of the day. The pendulum swung against the gilt-edged market on Friday, which was a flat day and prone to realize. Consols receded, Rails were down again, though not seriously lower, and the rest rather poor. Saturday was quiet and uninteresting. Markets were irregular where they moved at all. Consols closed at 77⅞-78⅛—only a gain of ⅛ in the week. Money was easy up until Thursday, when the Bank rate was lowered from 4 per cent. to 3½ per cent.; but it hardened later. Business in the Gas Market was quite lively; some issues showing a degree of activity to which they had long been strangers. Everything was strong, and quotations advanced nicely; the position and prospects of the gas industry in general being regarded as thoroughly satisfactory. In Gaslight and Coke issues, the ordinary was again well supported, transactions ranging from 106⅜ to 107½—a rise of ½. In the secured issues, the maximum was dealt in at 85½ special to 87, the preference at 103⅜, and the debenture at 79¼. South Metropolitan aroused into great activity, and was done at 116½ to 117½; while the debenture was brisk at 78⅜ to 79½. In Commercials, the 4 per cent realized 110½ and 111½, and the 3½ per cent. 105 and 106½. Among the Suburban and Provincial group, Alliance and Dublin was dealt in at 79⅜ to 81, ditto debenture at 91 and 91½, Brentford old at 261, British at 45⅝, Bournemouth "B" at 16⅜, Hastings 3½ per cent. at 95½ special, and (without being dealt in) Brighton ordinary, Ilford (both issues), Lea Bridge, South Suburban, Tottenham (both issues), and (on the local Exchanges) Liverpool and South Shields, advanced in price. In the Continental companies, Imperial changed hands at 190¾ special to 191½, ditto debenture at 90½ to 91, Union at 84½, ditto preference at 133⅜ and 133½, and European at 20⅜ to 21—a rise of ⅛. Among the undertakings of the remoter world, Cape Town preference was done at 4⅝ and 5, ditto debenture at 76¾, Primitiva at 7 11/16 to 7 13/16, ditto preference at 5½ to 5⅝, ditto debenture at 99, and San Paulo at 11 13/16 and 11⅞—a rise of ¼.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 12	5	Alliance & Dublin Ord.	79—82	..	6 1 11
374,000	Stk.	Jan. 12	4	Do. 4 p.c. Deb.	91—93	..	4 6 0
250,000	5	Sept. 28	7	Bombay, Ltd.	6—6½	..	5 7 8
50,000	10	Aug. 31	15	Bourne- 10 p.c.	29—30	..	5 0 0
311,810	10	"	7	mouth Gas B 7 p.c.	16⅛—16⅜	..	4 3 7
75,000	10	"	6	and Water) Pref. 6 p.c.	14⅛—14⅜	..	4 1 4
330,000	Stk.	Aug. 16	13	Brentford Consolidated	257—262	..	4 19 3
330,000	"	"	10	Do. New	198—203	..	4 18 6
50,000	"	"	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
206,250	"	Dec. 14	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
220,000	Stk.	Aug. 31	11	Brighton & Hove Orig.	217—222	..	4 19 1
246,320	"	"	8	Do. A Ord. Stk.	159—162	+2	4 18 9
490,000	20	Sept. 28	12½	British	44½—45½	..	5 9 11
120,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb. Stk.	92—94	..	4 5 1
109,000	"	Aug. 16	6	Bromley, A 5 p.c.	129—134	..	4 9 7
165,700	"	"	4½	Do. B 5½ p.c.	100—103	..	4 7 5
82,278	"	"	5½	Do. C 5 p.c.	120—125	..	4 8 0
55,000	"	Dec. 29	3½	Do. 3½ p.c. Deb.	80—82	..	4 5 4
250,000	Stk.	"	4	Buenos Ayres 4 p.c. Deb.	94—96	..	4 3 4
100,000	10	—	—	Cape Town & Dis., Ltd.	2—3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4¼—5½	..	—
100,000	Stk.	Dec. 29	4½	Do. 4½ p.c. Deb. Stk.	76—80	..	5 12 6
157,150	Stk.	Aug. 16	5	Chester 5 p.c. Ord.	111—113	..	4 8 6
1,513,280	Stk.	"	5/9/4	Commercial 4 p.c. Stk.	110—112	..	4 17 7
560,000	"	"	5½	Do. 3½ p.c. do.	105—107	..	4 19 8
475,000	"	Dec. 14	3	Do. 3 p.c. Deb. Stk.	75—77	..	3 17 11
800,000	Stk.	"	4	Continental Union, Ltd.	82—85	..	4 14 2
200,000	"	"	7	Do. 7 p.c. Pref.	132—134	..	5 4 6
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	"	—	4	Do. Deb. Stk.	104—105	..	3 16 2
840,150	10	Jan. 31	10	European, Ltd.	20¼—21¼*	+¼	4 14 1
16,160,600	Stk.	Aug. 16	4/14/8	Gas- 4 p.c. Ord.	106½—107½	+½	4 8 0
2,600,000	"	"	8½	light 3½ p.c. max.	85—87	..	4 0 6
4,062,235	"	"	4	and 4 p.c. Con. Pref.	103—105	..	3 16 2
4,531,705	"	Dec. 14	3	Coke 3 p.c. Con. Deb.	79—81	..	3 14 1
258,740	Stk.	Sept. 14	5	Hastings & St. L. 3½ p.c.	95—97	..	5 3 1
82,500	"	"	6½	Do. do. 5 p.c.	—	..	—
70,000	10	Oct. 12	11	Hongkong & China, Ltd.	17—17⅛	..	6 5 9
131,000	Stk.	Sept. 14	7½	Ilford A and C	155—158	+1	4 14 11
66,780	"	"	6	Do. B	126—129	+1	4 13 0
66,500	"	Dec. 29	4	Do. 4 p.c. Deb.	92—94	..	4 5 1
4,940,000	Stk.	Nov. 10	9	Imperial Continental	190—192	..	4 13 9
1,235,000	Stk.	Aug. 16	3½	Do. 3½ p.c. Deb. Red.	90—93	..	3 16 1
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.	127—132	+2	4 10 11
561,000	Stk.	Aug. 16	10	Liverpool United A.	220—222	+1	4 10 1
718,100	"	"	7	Do. B.	163—165	..	4 4 10
306,083	"	Dec. 29	4	Do. Deb. Stk.	100—102	..	3 18 5
75,000	5	Dec. 14	6	Malta & Mediterranean	4⅜—5	..	6 0 0
560,000	100	Oct. 2	5	Met. of 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	"	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	Nov. 10	3½	Monte Video, Ltd.	12—12½	..	5 12 0
1,775,892	Stk.	July 28	4⅜	Newc'tle&G'tesh'd Con.	103—105	..	4 3 4
529,705	Stk.	Dec. 29	3½	Do. 3½ p.c. Deb.	85—87	..	4 0 6
55,940	10	Aug. 31	7/7/0	North Middlesex 7 p.c.	14⅛—15½	..	4 14 10
300,000	Stk.	Dec. 14	8	Oriental, Ltd.	137—139	+1	5 15 1
60,000	5	Sept. 28	8	Ottoman, Ltd.	7—7⅛	+¼	5 6 8
31,800	53	Aug. 16	13	Portsea Island A	140—145	..	4 14 10
60,000	50	"	13	Do. B	133—138	..	4 14 2
100,000	50	"	12	Do. C	130—135	..	4 8 11
398,490	5	Oct. 12	8	Primitiva Ord.	7⅛—7⅜	..	5 3 3
796,980	5	Dec. 29	5	Do. 5 p.c. Pref.	5⅛—5⅜	..	4 13 0
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
812,650	Stk.	Dec. 29	4	River Plate 4 p.c. Deb.	94—96	..	4 3 4
250,000	5	Sept. 28	12	San Paulo, Ltd.	11—11⅛	+⅛	5 4 4
115,000	10	"	6	Do. 6 p.c. Pref.	11⅛—12	..	5 0 0
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.	49—50	..	5 0 0
135,000	Stk.	Aug. 31	10	Sheffield A	240—242	..	4 2 8
209,984	"	"	10	Do. B	239—241	..	4 3 0
523,500	"	"	10	Do. C	239—240	−½	4 3 4
90,000	10	Sept. 28	6	South African	8—9	..	6 13 4
6,429,895	Stk.	Aug. 16	5/9/4	South Met., 4 p.c. Ord.	116—118	..	4 12 8
1,895,445	"	Jan. 12	3	Do. 3 p.c. Deb.	78—80	..	3 15 0
209,820	Stk.	Aug. 16	8½	South Shields Con. Stk.	159—161	+2	5 5 7
605,000	Stk.	"	5/16/8†	S'th Suburb'n Ord. 5 p.c.	123—125	+1	4 13 3
60,000	"	"	5	Do. 5 p.c. Pref.	117—120	..	4 3 4
117,058	"	Jan. 12	5	Do. 5 p.c. Deb. Stk.	119—121	..	4 2 8
502,310	Stk.	Nov. 10	5	Southampton Ord.	107—109	..	4 11 9
120,000	Stk.	Aug. 16	7½	Tottenham A 5 p.c.	146—149	+1	4 15 8
483,940	"	"	5⅝	and B 3½ p.c.	116—118	+1	4 15 4
149,470	"	Dec. 29	4	Edmonton 4 p.c. Deb.	94—96	..	4 3 4
182,380	10	"	5	Tuscan, Ltd.	8½—9	..	5 11 1
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	99—101	..	4 19 0
236,476	Stk.	Aug. 16	5	Tynemouth, 5 p.c. max.	114—116	..	4 6 2
255,636	Stk.	Aug. 31	6¼	Wands- B 3½ p.c.	143—146	..	4 14 3
85,766	"	Dec. 29	3	worth 3 p.c. Deb. Stk.	71½—73½	..	4 1 8

Prices marked * are "Ex. div." † Next dividend will be at this rate.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

ENGINEER AND MANAGER. Brecon Gas-Works.
CHIEF CHEMIST. Salford Gas Department. Applications by Feb. 22.
ASSISTANT. Ormskirk Gas Company.
DRAUGHTSMEN. Newton, Chambers, and Co., Sheffield.
DRAUGHTSMAN. Sunderland Gas Company.
REPRESENTATIVE (High-Pressure Lamps, &c.). No. 5521.
WORKS FOREMAN. Spennymoor and Tudhoe Gas Company.
SUPERVISION OF WATER-GAS PLANT. Devonport Gas Department. Applications by Feb. 20.
CHARGE OF BURNER MAINTENANCE DEPARTMENT. No. 5522.
GAS-FITTER. No. 5523.
CHEMICAL PLUMBERS. Joseph Taylor and Co., Bolton.

Appointments, &c., Wanted.

CHEMICAL PLUMBER, &c. No. 5492.
GENERAL CLERK. No. 5524.
MANAGER OR SUPERINTENDENT. No. 5518.

Concessions (Water and Electricity), &c., in Holland.

"Water and Light" Technische Boekhandel Waltman, Delft.

Sales of Stocks and Shares.

CREDITON GAS COMPANY. By Auction. Rougemont Hotel, Exeter. Feb. 22.
SOUTHEND WATER COMPANY. By Auction, at the Mart. Feb. 20.

Meetings.

BARNET GAS AND WATER COMPANY. Holborn Restaurant. Feb. 29. 1.30 o'clock.
BRENTFORD GAS COMPANY. St. Ermin's Hotel, Westminster. Feb. 23. 2.30 o'clock.
CHICHESTER GAS COMPANY. Gas-Works. Feb. 27. One o'clock.
HARROW AND STANMORE GAS COMPANY. Holborn Restaurant. March 4. Twelve o'clock.
HORNSEY GAS COMPANY. 63, Chancery Lane, W.C. March 1, 3.30 o'clock.
MITCHAM AND WIMBLEDON GAS COMPANY. Gas Offices. Feb. 27. Three o'clock.
NORTH MIDDLESEX GAS COMPANY. 5, Great Winchester Street, E.C. Feb 26. 2.30 o'clock.
RIDDINGS GAS COMPANY. 6 and 7, Queen Street, E.C. Feb. 29. Four o'clock.

TENDERS FOR

Cookers, &c.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 20.
PONTYPRIDD GAS DEPARTMENT. Tenders by Feb. 21.

Fire-Clay Goods, &c.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 20.
PONTYPRIDD GAS DEPARTMENT. Tenders by Feb. 21.

General Stores (Sulphuric Acid, Oil, Lime, Ironmongery, Benzol, Barrows, Tools, Lead and Compo. Tube, &c., Copper, Main Taps and Locks, Cocks, &c.)

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 20.
NELSON GAS DEPARTMENT. Tenders by Feb. 19.
PONTYPRIDD GAS DEPARTMENT. Tenders by Feb. 21.

Lighting Appliances (Mantles, Burners, Lamps, Glassware, Brackets, &c., Slot Fittings, &c.).

DUBLIN CORPORATION. Tenders by Feb. 14.
PONTYPRIDD GAS DEPARTMENT. Tenders by Feb. 21.
TEIGNMOUTH URBAN DISTRICT COUNCIL. Tenders by Feb. 24.

Meters, &c.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 20.
PONTYPRIDD GAS DEPARTMENT. Tenders by Feb. 21.

Oil for Gas Making.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 20.

Oxide of Iron.

TYLDESLEY GAS DEPARTMENT. Tenders by March 4.

Pipes, &c.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 20.
PONTYPRIDD GAS DEPARTMENT. Tenders by Feb. 21.

Tar and Liquor.

HAWORTH URBAN DISTRICT COUNCIL. Tenders by Feb. 26.
NELSON GAS DEPARTMENT. Tenders by Feb. 19.
PONTYPRIDD GAS DEPARTMENT. Tenders by Feb. 21.